NHS SCOTLAND

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scottish intensive care society audit group

Audit of Critical Care in Scotland 2018
Reporting on 2017

First published October 2009

ISBN: 978-1-84134-014-2

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Foreword

This report describes the activities and outcomes for Scottish Intensive Care Units (ICU) and High Dependency Units (HDU) in 2017. It is a continuing development of the original critical care outcomes and process audit that has produced an ever expanding national dataset since 1995.

The Scottish Intensive Care Society Audit Group (SICSAG) is a national critical care audit and quality assurance program and a close collaboration between the Scottish Intensive Care Society (SICS) and Information Services Division (ISD). We are grateful to remain fully funded through the Scottish Healthcare Audits, ISD and National Services Scotland.

SICSAG exists to strive to continually improve the quality of care that is delivered to critical care patients across Scotland by continuous monitoring and transparently comparing interventions, activities and outcomes. We are also closely aligned with the Scottish Government's 2020 Vision[1].

This national audit seeks to inform healthcare professionals, the public and service commissioners by transparently providing ongoing quality assurance data on the quality of care provided nationally for this group of critically ill patients.

The report this year highlights some real disparity between the provision of critical care across the territorial NHS Boards and I would urge those boards that appear to have lower levels of critical care provision to scrutinise this report in detail and to consider their local investment decisions. We highlight the increasing need for intensive care beds to support hospitals caring for an aging population with increased co-morbidities and complex chronic health conditions.

There are challenges, particularly around early and night time discharges from critical care. There is also increasing evidence that some areas of Scotland have inadequate critical care capacity.

We continue our close collaboration with Health Protection Scotland (HPS) to collect, analyse and report on Healthcare Associated Infections (HAI) across Scottish ICU's. Once again we are able to report jointly, reflecting the importance of ongoing continuous surveillance of HAI as a marker of quality within critical care.

The continued expansion of the audit together with the increasing number of units now participating means that in 2017 we report on almost 47,000 critically ill patients.

To the best of our knowledge, this audit remains the only one in the world which reports named unit level outcomes to this level of public scrutiny and detail.

Measures of success include the ongoing benchmarking of professionally agreed Minimum Standards and Quality Indicators (MSQI) across critical care in Scotland[2]. We report these in a more detailed and transparent way this year and once again we will include them in the SICSAG governance process.

We will continue to support units through the publication and scrutiny of data in order to improve both patient care and patient experience in critical care units across Scotland.

I note once again that some units are struggling with the provision of protected time to collect data and would challenge all NHS Boards to continue to provide the necessary support required to ensure that they are able to participate fully in this well established, internationally leading, quality assurance program.

The continued success of the audit would not be possible without the ongoing commitment, support and hard work of the entire Scottish critical care clinical community.

Particular thanks go to the SICSAG steering group, Paul Smith (National Clinical Coordinator), Ros Hall (Regional Coordinator), Lorraine Smyth, (Senior Information Analyst), Clare McGeoch (Quality Assurance Manager) and the network of Local Audit Team Coordinators.

The annual conference held in conjunction with the Scottish Critical Care Specialty Group will take place this year on 6th and 7th September 2018, details of this and significant amounts of further detailed critical care data that are not published in this report are available at www.sicsag.scot.nhs.uk.

Dr Stephen Cole

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Unit Key

Letter	Abbreviation	Unit Name	NHSBoard
A	IRH ICU	Inverclyde Royal Hospital ICU	Greater Glasgow & Clyde
A2	IRH HDU	Inverclyde Royal Hospital HDU	Greater Glasgow & Clyde
AA1	Dr Grays HDU	Dr Gray's HDU	Grampian
AB1	WIH HDU	Western Isles Hospital Stornoway	Western Isles
AC1	Belford HDU	Belford HDU	Highland
AD1	GJNH CICU/CHDU	Golden Jubilee Hospital ICU/HDU	National Waiting Times Centre
AE1	Balfour HDU	Balfour Hospital, Orkney HDU	Orkney
B	VHK ICU	Victoria Hospital Kirkcaldy ICU	Fife
B2	VHK MHDU	Victoria Hospital Kirkcaldy Medical HDU	Fife
B3	VHK SHDU	Victoria Hospital Kirkcaldy Surgical HDU	Fife
B4	VHK RHDU	Victoria Hospital Kirkcaldy Renal HDU	Fife
C	PRI ICU	Perth Royal Infirmary ICU	Tayside
C2	PRI HDU	Perth Royal Infirmary HDU	Tayside
E	Ayr ICU	Ayr Hospital ICU	Ayrshire & Arran
E2	Ayr HDU	Ayr Hospital HDU	Ayrshire & Arran
G	CRH ICU	Crosshouse Hospital ICU	Ayrshire & Arran
G2	CRH MHDU	Crosshouse Hospital Medical HDU	Ayrshire & Arran
G3	CRH SHDU	Crosshouse Hospital Surgical HDU	Ayrshire & Arran
G4	PRM OHDU	Princess Royal Maternity Hospital	Greater Glasgow & Clyde
H	DGRI ICU	Dumfries & Galloway ICU	Dumfries & Galloway
H2	DGRI MHDU	Dumfries & Galloway Medical HDU	Dumfries & Galloway
H3	DGRI SHDU	Dumfries & Galloway Surgical	Dumfries & Galloway
H4	DGRI ICU/HDU	Dumfries & Galloway Combined Unit	Dumfries & Galloway
I3	MDGH MHDU	Monklands DGH Medical HDU	Lanarkshire
I4	MNK ICU/HDU	Monklands Combined Unit	Lanarkshire
I5	MNK level 1 HDU	Monklands Level 1	Lanarkshire
J	RAH ICU	Royal Alexandra Hospital ICU	Greater Glasgow & Clyde
J2	RAH HDU	Royal Alexandra Hospital HDU	Greater Glasgow & Clyde
K	GRI ICU / HDU	Glasgow Royal Infirmary ICU	Greater Glasgow & Clyde
K2	GRI SHDU	Glasgow Royal Infirmary Surgical HDU	Greater Glasgow & Clyde
K3	GRI MDU	Glasgow Royal Infirmary Medical HDU	Greater Glasgow & Clyde
M	SJH ICU/HDU	St Johns Hospital, Livingston	Lothian
N	NWD ICU	Ninewells Hospital ICU	Tayside
N2	NWD MHDU	Ninewells Hospital Medical HDU	Tayside
N3	NWD SHDU	Ninewells Hospital Surgical HDU	Tayside
N5	NWD OHDU	Ninewells Hospital Obstetric HDU	Tayside

Letter	Abbreviation	Unit Name	NHSBoard
P	RGM ICU	Raigmore Hospital ICU	Highland
P2	RGM MHDU	Raigmore Hospital Medical HDU	Highland
P3	RGM SHDU	Raigmore Hospital Surgical HDU	Highland
Q3	FVRH ICU/HDU	Forth Valley Royal Hospital	Forth Valley
QE1	QEU ICU	South Glasgow University Hospital ICU 3&4	Greater Glasgow & Clyde
QE2	QEU HDU1	South Glasgow Univeristy Hospital HDU 1	Greater Glasgow & Clyde
QE3	QEU HDU2	South Glasgow Univeristy Hospital HDU 2	Greater Glasgow & Clyde
QE4	QEU HDU6	South Glasgow Univeristy Hospital HDU 6	Greater Glasgow & Clyde
QE5	QEU MHDU	South Glasgow University Hospital Medical HDU 5	Greater Glasgow & Clyde
QE6	QEU OHDU	South Glasgow University Hospital Obstetrics HDU	Greater Glasgow & Clyde
R	WGH ICU/HDU	WGH, Edinburgh ICU/HDU	Lothian
R3	WGH SHDU	WGH, Edinburgh Surgical(Level 1)	Lothian
R4	WGH NHDU	WGH, Edinburgh Neuro HDU	Lothian
R5	WGH NHDU (Level 1)	WGH, Edinburgh Level 1 Neuro HDU	Lothian
S	HRM ICU/HDU	Hairmyres Hospital ICU/HDU	Lanarkshire
S2	HRM MHDU	Hairmyres Hospital Medical HDU	Lanarkshire
U	BGH ICU/HDU	Borders General Hospital ICU/HDU	Borders
V	WSH ICU	Wishaw General Hospital ICU	Lanarkshire
V2	WSH SHDU	Wishaw Surgical HDU	Lanarkshire
V3	WSH MHDU	Wishaw Medical HDU	Lanarkshire
W	ARI ICU	Aberdeen Royal Infirmary ICU	Grampian
W14	ARI SHDU	Aberdeen Surgical HDU	Grampian
W2	ARI SHDU (31/32)	Aberdeen Royal Infirmary Surgical HDU	Grampian
W4	ARI SHDU (35)	Aberdeen Royal Infirmary Surgical HDU	Grampian
W7	ARI CICU	Aberdeen Royal Infirmary Cardiothoracic ICU	Grampian
W8	ARI MHDU	Aberdeen Royal Infirmary Medical HDU	Grampian
W9	ARI OHDU	Aberdeen Royal Infirmary Obstetric HDU	Grampian
X	RIE ICU/HDU	RI Edinburgh ICU/HDU (118)	Lothian
X13	RIE RTHDU	RIE joint Renal Transplant HDU	Lothian
X14	RIE OHDU	RIE Obstetrics HDU	Lothian
X2	RIE HDU	RI Edinburgh HDU (116)	Lothian
X6	RIE CICU	RI Edinburgh Cardiothoracic ICU (111)	Lothian
X7	RIE CHDU	RI Edinburgh Cardiothoracic HDU (112)	Lothian
Y	SGH NICU	Southern General Hospital Neuro ICU	Greater Glasgow & Clyde
Y2	SGH NHDU	Southern General Hospital Neuro HDU	Greater Glasgow & Clyde
Z1	GBH HDU	Gilbert Bain Hospital, Shetland	Shetland

List of Abbreviations

4AT	A rapid clinical instrument for delirium detection
ACP	Augmented Care Period
AMR	Antimicrobial Resistance
APACHE	Acute Physiology and Chronic Health Evaluation
AUC	Area Under the Curve
BSI	Bloodstream Infection
CABG	Coronary Artery Bypass Graft
CAMICU	Confusion Assessment Method in the ICU
CHDU	Cardiothoracic HDU
CI	Confidence Interval
CICU	Cardiothoracic ICU
CLABSI	Central Line-Associated Bloodstream Infection
COMQI	Clinical Outcome Measures for Quality Improvement
CPAP	Continuous Positive Airway Pressure
CPOT	Critical Care Pain Observation Tool
CR-BSI	Catheter Related Bloodstream Infection
CRI	CVC Related Infection
CUSUM	Cumulative Sum Control Chart
CVC	Central Venous Catheter
DATIX	Electronic risk management system used in Healthcare
ECDC	European Centre for Disease Prevention and Control
GDPR	General Data Protection Regulation
GI	Gastrointestinal
GPICS	Guidelines for the Provision of Intensive Care Services
HAI	Healthcare Associated Infection
HDU	High Dependency Unit
HPS	Health Protection Scotland
HQIP	The Healthcare Quality Improvement Partnership
IAP	Intubation Associated Pneumonia
ICS	Intensive Care Society

4AT	A rapid clinical instrument for delirium detection
ICU	Intensive Care Unit
ICU/HDU	Combined Intensive Care Unit and High Dependency Unit
IRR	Inter-Rater Reliability
ISD	Information Services Division
MFI	Model For Improvement
MHDU	Medical HDU
MSQI	Minimum Standards and Quality Indicators
M & M	Morbidity and Mortality
NCT	Non Clinical Transfer
NHDU	Neurological HDU
NICE	National Institute for Health and Care Excellence
NICU	Neurological ICU
NIV	Non-Invasive Ventilation
NRS CCSG	NHS Research Scotland Critical Care Specialty Group
OHDU	Obstetric HDU
PHI	Public Health and Intelligence
PN	Pneumonia
PVC	Peripheral Venous Cannula
QI	Quality Improvement
RHDU	Renal HDU
RRT	Renal Replacement Therapy
RTHDU	Renal Transplant HDU
SAER	Significant Adverse Events Review
SCN	Senior Charge Nurse
SD	Standard Deviation
SHDU	Surgical HDU
SICS	Scottish Intensive Care Society
SICSAG	Scottish Intensive Care Society Audit Group
SHA	Scottish Healthcare Audit
SMaCC	Scottish Maternity Critical Care Group
SMR	Standardised Mortality Ratio
UKCCNA	UK Critical Care Nursing Alliance
VAP	Ventilator Associated Pneumonia
WTE	Whole Time Equivalent

Key findings

- 19% of patients admitted to Intensive Care Units died before they were discharged from hospital.
- No unit was found to have a significantly higher mortality rate compared to the rest of Scotland.
- Shortage of beds was a theme impacting on critical care in 2017. Units were not always able to discharge their patients at an appropriate time with 22% and 25% of discharges from High Dependency Units and Intensive Care Units delayed more than four hours respectively. This is also reflected in figures for night time discharges and early discharges.
- Overall there has been improvement in units attaining the minimum standards and quality indicators from 2016, however some remain challenging for units.
- In 2017, 2.7% of patients in intensive care units developed a Healthcare Associated Infection and this remains unchanged from 2016.

Introduction

This report follows a patient's journey through critical care focusing on: outcomes, quality indicators, activity, interventions and HAI in critical care. All data are presented in tables and charts, with accompanying text to alert the reader to points of interest. When interpreting the unit-level charts it is very important to remember that each unit is unique in terms of case load, patient case-mix and geographical factors. These may all contribute to any differences seen.

Please refer to the SICSAG website (www.sicsag.scot.nhs.uk) for information on the methodology of the audit and for Data Protection GDPR information.

Minimum Standards & Quality Indicators (MSQI)

This is the second year of reporting the revised MSQIs[2]. Whilst they remain stretching and ambitious, SICSAG have developed the reporting of these standards and indicators to reflect better the amount of work that units are doing to achieve them. Rather than using the system of reporting either fully/partially/not achieving, we have introduced a stepped reporting mechanism that covers:

- Unit fully meeting this indicator
- Unit meeting this indicator in the majority of cases
- Unit meeting this indicator in some cases
- Unit is failing to meet this indicator.

It should be noted that with publishing these data, there is no intention to judge what is 'correct' but to demonstrate visually comparative benchmarking to inform quality improvement. We are sure that this will assist units in driving forward their plans and work to achieve these standards and indicators in the future. The Steering Group are also seeking to collaborate with networks across Scotland on achieving, and future review of these standards and indicators.

Funnel Plots

Throughout the report, funnel plots are used to allow comparisons to be made between different service providers. These control charts can help guide quality improvement activities by flagging up areas where there is evidence of variation. Our confidence of a real difference from the Scottish mean is weaker between 2 standard deviations (SD) and 3SD, and stronger if the unit lies outside the 3SD line. It should be recognised that in a comparison of 25 units, there is a considerable chance of an outlier at the 2 SD (5% or 1 in 20) level. Where there are significant statistical differences with the units and the Scottish mean, it may warrant further local investigation. Differences may arise from many sources for example, in data accuracy, case-mix, service provision or practice. Sometimes a difference will be just a random variation caused by chance alone. SICSAG encourage readers to use the data to examine practice in the context of the factors listed.

WardWatcher Upgrade

Following the roll-out of HAI surveillance to the HDUs in 2016, the SIGSAG Steering Group and its HAI subgroup decided to embark on an upgrade to the WardWatcher data collection platform. This was to make the collection of HAI surveillance data more efficient and accurate.

The process of upgrading WardWatcher began in January 2018 and was completed, including the necessary training, across all units in Scotland by the end of June. This remarkable work has been achieved by Regional Coordinator, Ros Hall and WardWatcher developer, Brian Millar. The audit gives thanks for their hard work in achieving this in such a short timeframe.

Inter-Rater Reliability (IRR)

IRR is a method of examining the consensus or homogeneity of data collection among different individuals. IRR cannot ensure 100% correlation of data extracted between different individuals at unit level, but it can assist with the estimation of the amount of error in the data collection process[3] and hence improve the quality of the data.

The Healthcare Quality Improvement Partnership (HQIP) suggests an agreement range of 90% to 95% being preferable but a minimum can be set at 85%[3]. SICSAG expects an agreement rate of 90% or greater.

SICSAG can report that after completing IRR across 12 units in Scotland to include some 6,000 variables that the mean IRR rate is 94% (range 75% to 100% for individual units). Where units initially scored a mean of under 90%, an educational programme was put in place by SICSAG for staff and follow up IRR increased to 98% after training.

It is important to note IRR is not a substitute for the implementation of governance issues surrounding CUSUM triggers, MSQIs not being met, or for data loss issues.

Spring WardWatcher Workshop

2018 saw the successful 3rd annual workshop for WardWatcher and quality improvement discussions held at Bridge of Allan.

SICSAG intends to keep this free event running in 2019.

Annual Conference

September 2017 saw a very successful conference in collaboration with the Scottish Critical Care Specialty Group. Highlights from the conference were:

- GENOMICC (Genetics of Susceptibility and Mortality in Critical Care)
- REBOA (Resuscitative Endovascular Balloon Occlusion of the Aorta)
- CHART ADAPT (Connecting Healthcare And Research Through A Data Analysis Provisioning Technology)
- InS:PIRE (Intensive Care Syndrome: Promoting Independence and Return to Employment)
- Sharing learning from a SICSAG low mortality outlier and
- ICU Strain.

The 2018 Conference will be held at the Golden Jubilee Hotel and Conference Centre on 6th & 7th September. Please register through the SICSAG website at; www.sicsag.scot.nhs.uk.

Masters Students

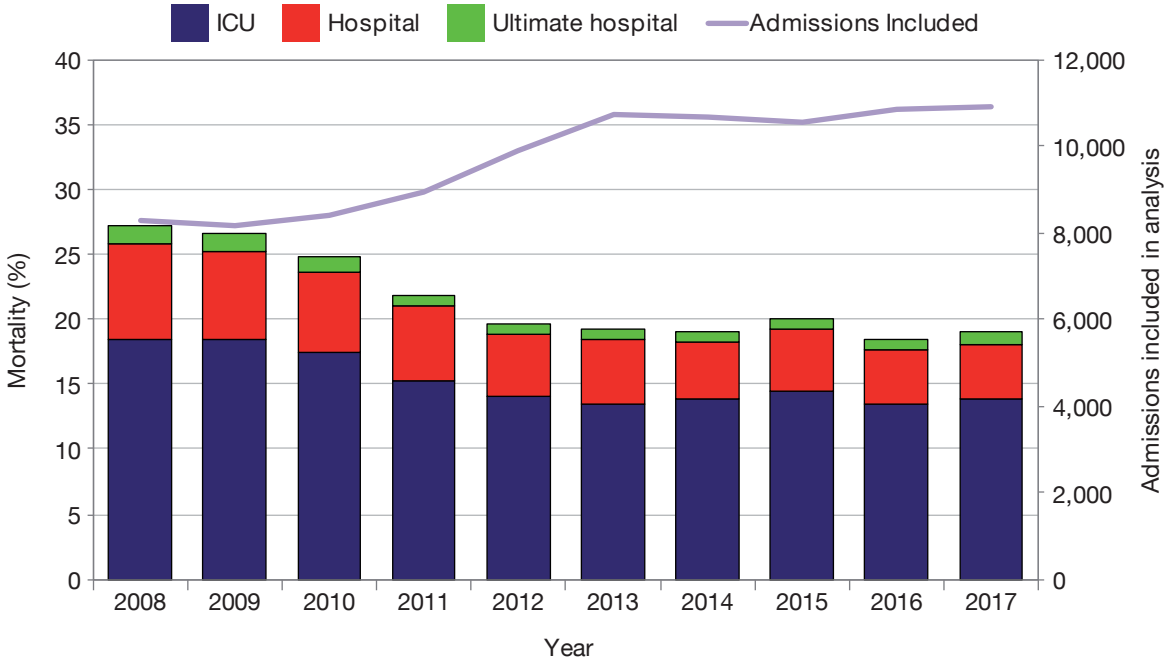
SICSAG collaborated with the University of Edinburgh in 2017 to enable two students to participate in their dissertations whilst analysing data from SICSAG. One student had a formal honorary contract and worked closely with the central team for his work whilst the other used data from an Information Request for data. Both students successfully presented their work at the Scottish Intensive Care Society Annual Scientific meeting in St Andrew's in January 2018 (see Appendix A).

Local Quality Improvement Projects

The Clinical Educator based in the ICU at Raigmore Hospital, as part of her Masters dissertation, initiated a quality improvement project that focused on improving the assessment and treatment of pain in the ICU. It was theorised that the process measures would lead to an improvement in these outcome measures: ventilator time and associated length of stay (see Appendix B).

Section 1 Outcomes

Figure 1 Scottish crude mortality of patients in ICU and combined units (2008-2017)



Note:

Only includes patients with mortality predictions.

Crude mortality in patients admitted to ICUs is at similar levels to previous years. In 2017 19% of patients died before their ultimate discharge from hospital. ICU mortality relates to patients dying in the unit of admission. Hospital mortality relates to patients dying post ICU discharge in the same hospital as the unit. The ultimate hospital mortality relates to mortality of patients transferred from the original admitting hospital. It should be remembered that the above data are not adjusted for illness severity or case-mix, which can change over time.

Figure 2 **Scottish Standardised Mortality Ratios in ICU and combined units, using the Standard APACHE II model (2008-2017) and Recalibrated APACHE II model (2009-2017)**

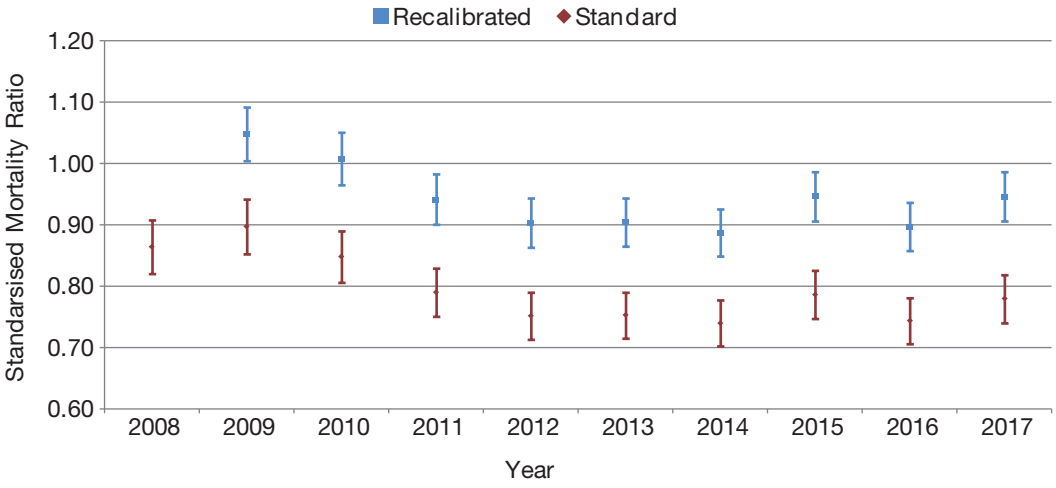


Figure 2 shows the Standardised Mortality Ratio (SMR) where the actual mortality is compared with expected mortality using APACHE II methodology (see www.sicsag.scot.nhs.uk).This allows a better comparison of mortality over time as illness severity and case-mix are adjusted.

The APACHE II scoring system was recalibrated to better reflect a Scottish population rather than an external reference population; however the standard is included here for international comparison. Both models follow a similar pattern over time and in 2017, the SMR remains at a similar level to previous years. The standard SMR was 0.78 and the recalibrated model was 0.95 which is closer to 1.0. This would be expected using a Scottish reference population.

Figure 3 **Standard Mortality Ratios using recalibrated APACHE II model in ICU and combined units (2017)**

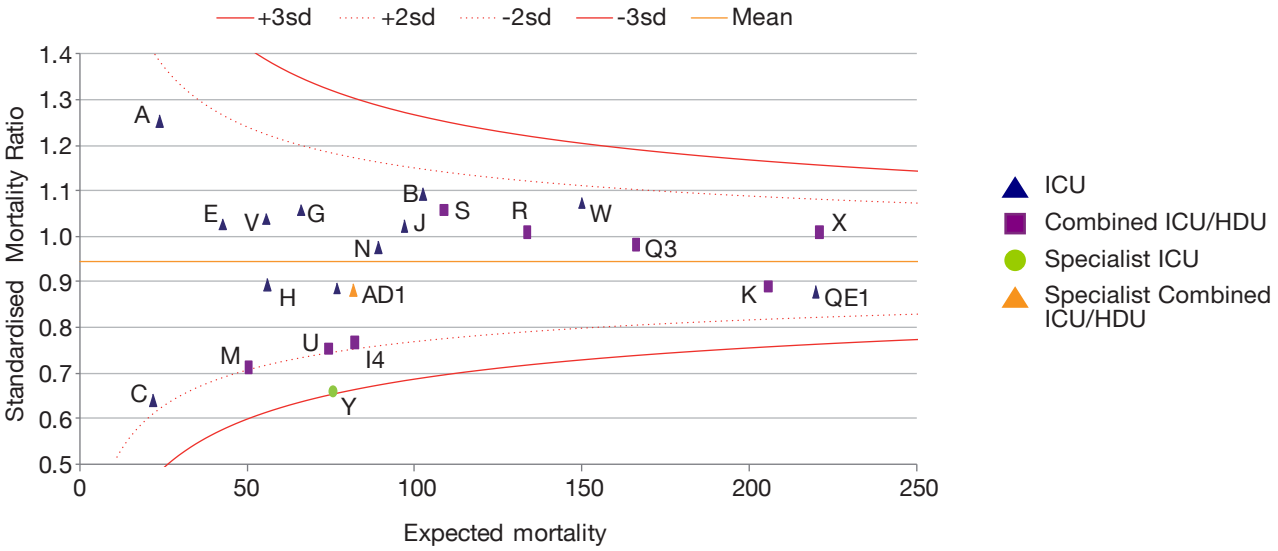
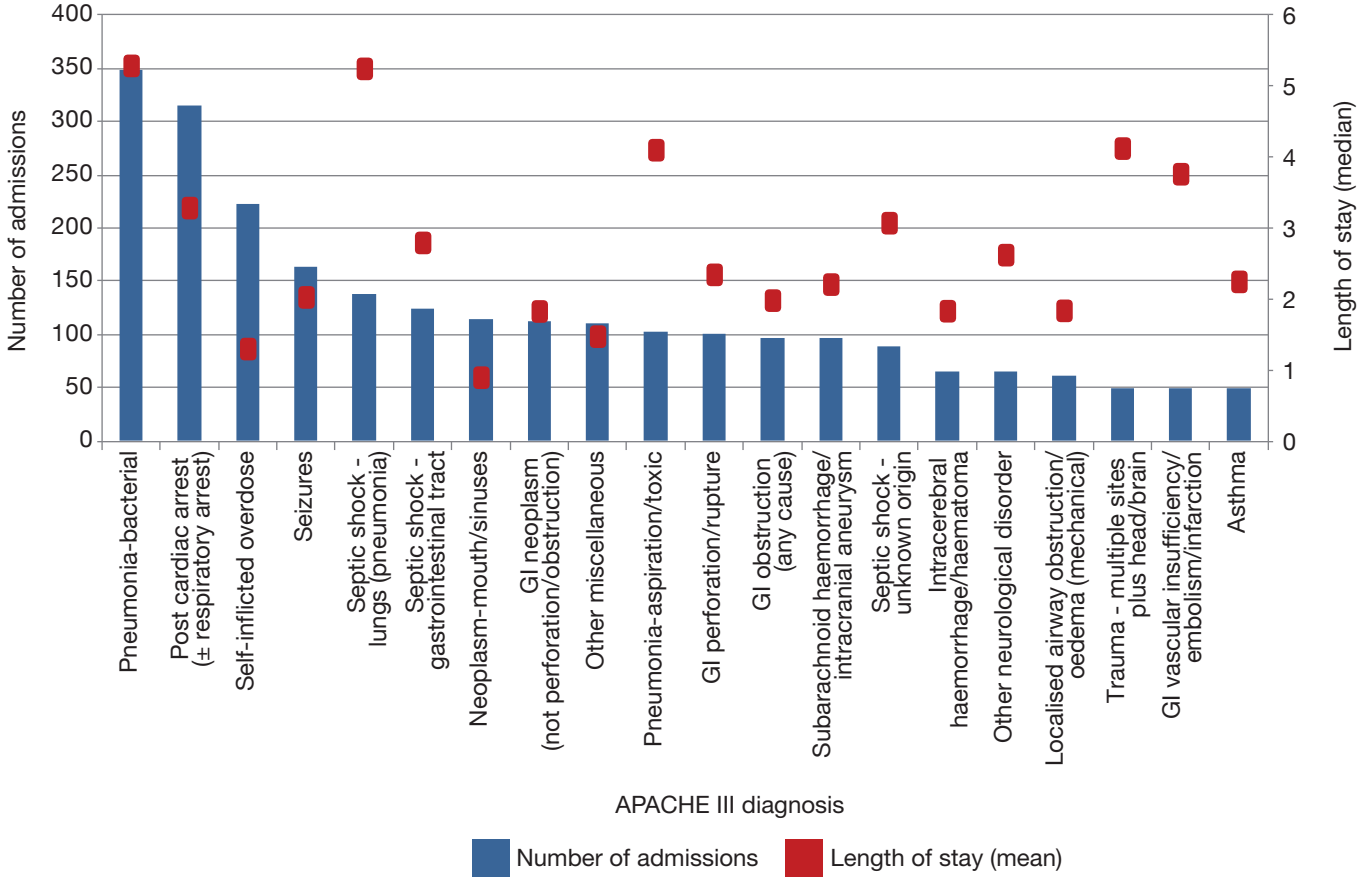


Figure 3 shows the SMR for ICU and combined units and is calculated using the recalibrated APACHE II model. Variation was within the limits of what would be expected. No units had

shown evidence of a higher SMR than the Scottish average. Unit Y (SGH NICU) are an outlier at the 2SD level, providing some weak evidence they have a statistically lower SMR than the Scottish average. This may be accounted for by case-mix.

Figure 4 Top 20 Apache III diagnoses in ICU and combined units with median length of stay for each diagnosis (2017)



The three most common general ICU diagnoses are bacterial pneumonia, post cardiac arrest and self-inflicted overdose. This pattern has remained similar in recent years.

Figure 5 Observed and predicted ultimate hospital mortality according to grouped APACHE II diagnosis in ICU and Combined Units (2017)

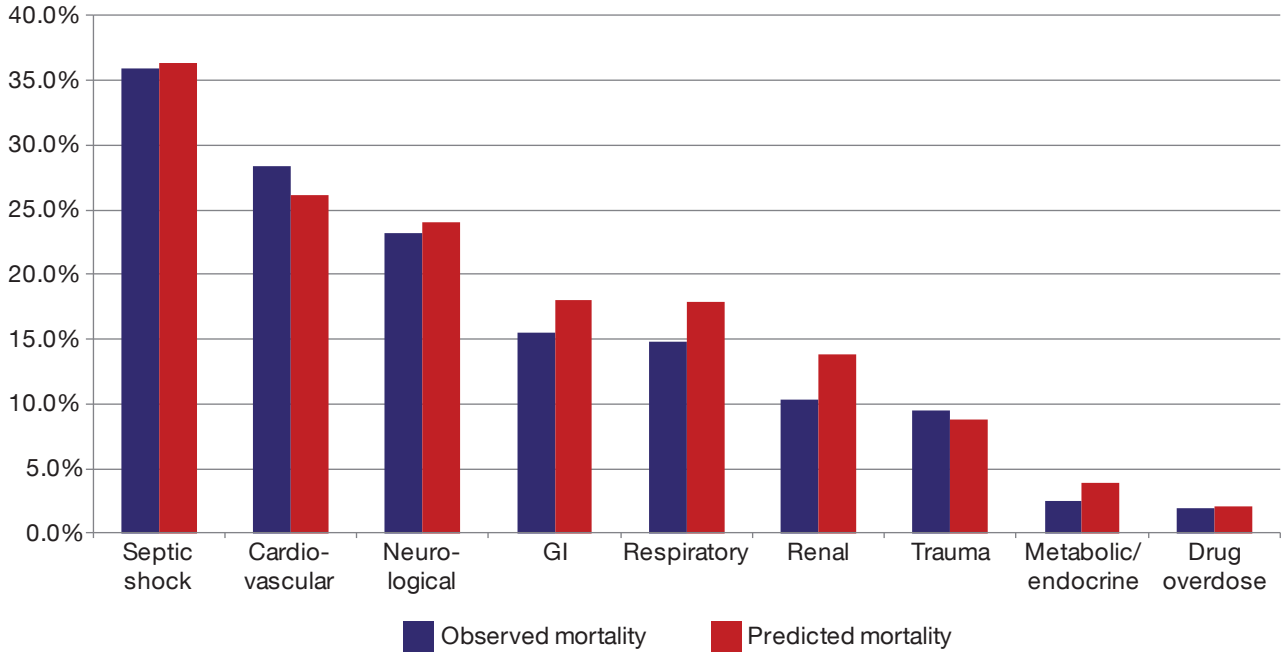
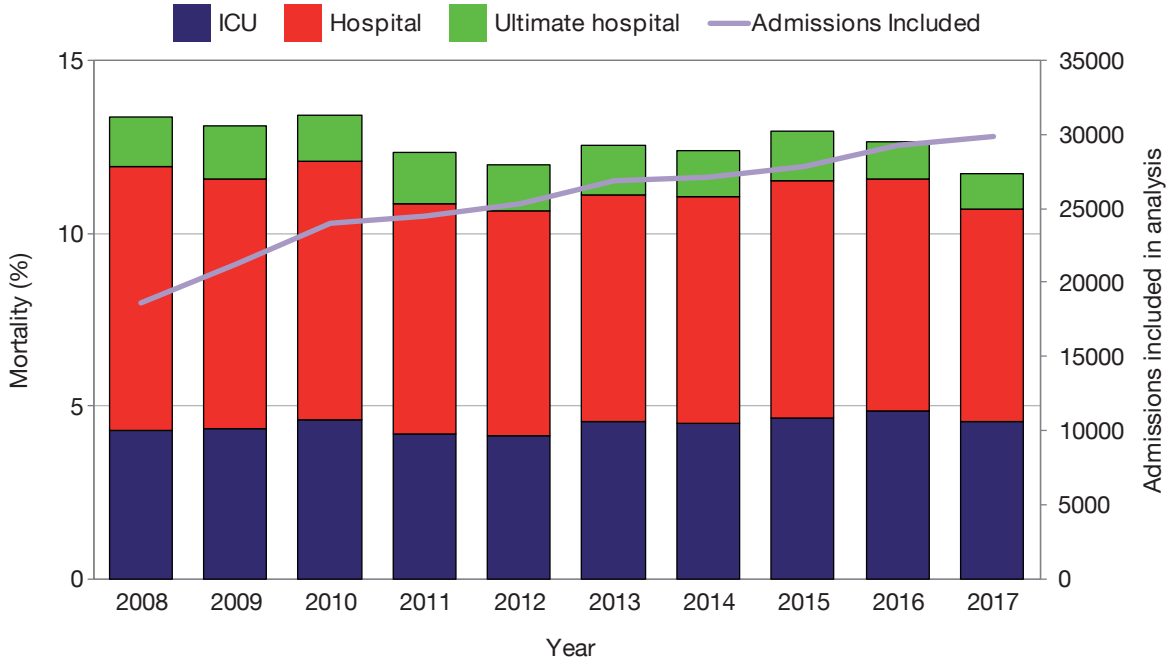


Figure 5 shows observed and predicted mortality for some of the most common diagnoses. This shows a wide range of mortality, which emphasizes the importance of entering the correct diagnosis in WardWatcher. Overall the observed and predicted mortality appear reasonably well matched.

Figure 6 Scottish crude mortality of patients in HDUs (2008-2017)

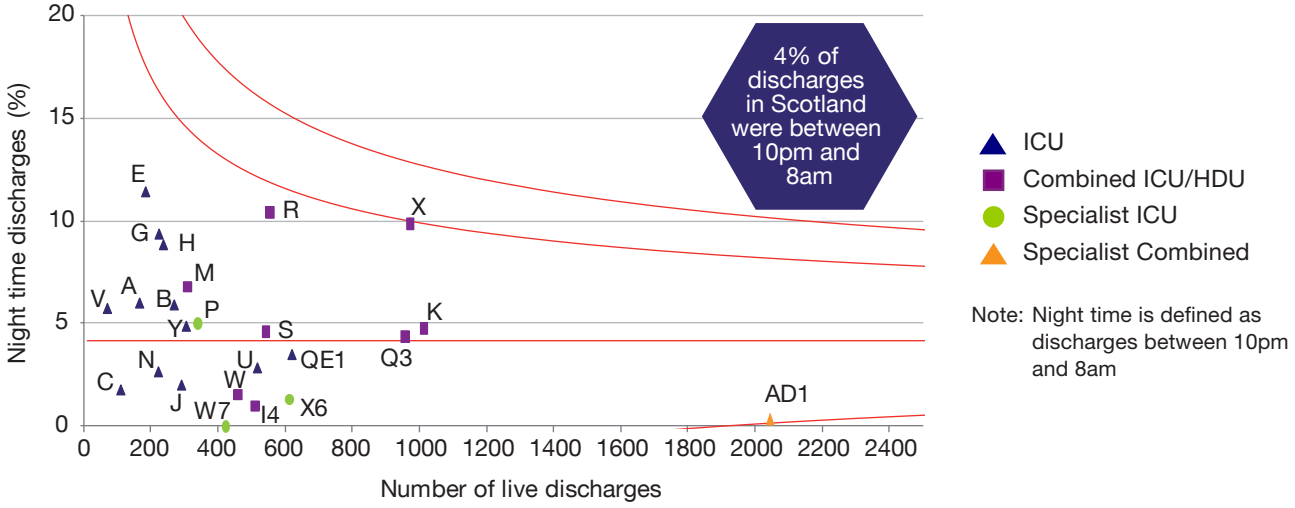


Crude mortality in patients admitted to HDUs is at similar levels to previous years. In 2017 12% of HDU patients died before their ultimate discharge from hospital as compared with 19% for ICU/combined units. It should be remembered that the above data are not adjusted for illness severity or case-mix, which can change over time.

Section 2 Quality Indicators

2.1 Night time discharges

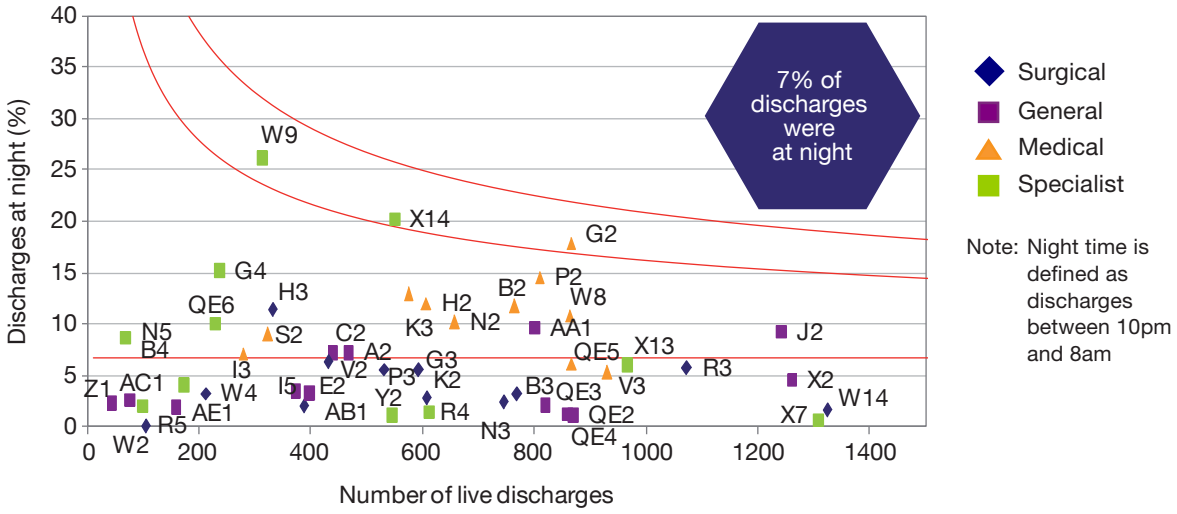
Figure 7 Night time discharges from ICU and combined units (2017).



Night time discharges have been associated with worse outcomes for patients and should be avoided where possible[4,5,6]. The average discharge at night in 2017 was 4%. Unit E (Ayr ICU) had the highest percentages of discharges at night, although as it lies within the SD lines there is no evidence of a real difference from the Scottish mean. For the vast majority of patients in Unit E (Ayr ICU) being moved at night, the unit outcome was 'improved', and most were moved to the HDU ward located beside the ICU.

Unit X (RIE ICU) is an outlier to 2SD and hence there is some weak evidence to support it is significantly different to the Scottish mean. Last year Unit X (RIE ICU) was an outlier to 3SD on this chart, therefore showing some improvement in night time discharges from 2016 to 2017. The vast majority of discharges from RIE ICU occur between 2200 and 0200. The unit has conducted a quality improvement project over the past 6 months in order to better understand the causes. It revealed that the majority of night time discharges are to the general HDU in RIE. The critical care medical and nursing teams in RIE have ongoing clinical responsibility for patients discharged to general critical care HDU wards. Therefore, whilst coded as early discharges from ICU in the database, these patients received ongoing management in an appropriate critical care environment by critical care trained medical and nursing staff. The high night time discharge rate is a reflection of delayed discharges to the ward, high occupancy levels, and the highest night time admission rates in Scotland. Consultants and senior nursing staff use critical care beds flexibly across the general critical care wards to meet this clinical demand.

Figure 8 Night time discharges in HDUs (2017)

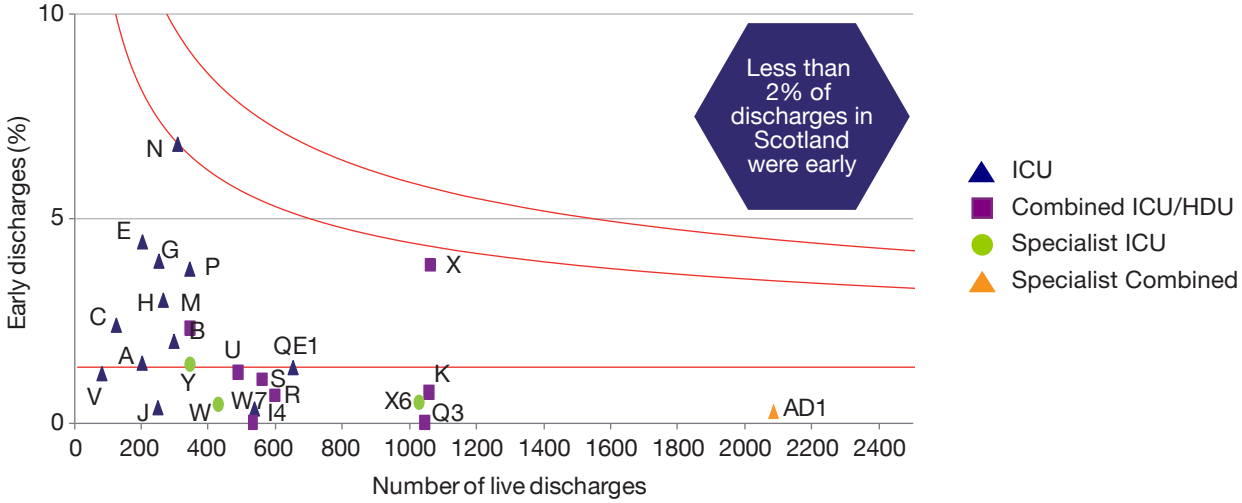


It is pleasing to note that Unit N5 (NWD OHDU) have significantly reduced the night time discharges from 2016 to 2017, as they were an outlier on this chart to 3SD in 2016.

There is some weaker evidence to support that Units W9 (ARI OHDU), X14 (RIE OHDU) and G2 (CRH MHDU) have higher night time discharges compared to the Scottish average, as these units are outliers on the chart to 2SD. The vast majority of patients discharged at night were moved to a ward in the same hospital. It is expected that obstetric specialist units would have higher night time discharges compared to other HDUs in Scotland. In this patient group, recovery often happens quickly and the turnover of patients is high. Patients are reviewed by a consultant obstetrician before discharge. There are known bed flow problems at Crosshouse MHDU, which are attributing to the higher rate of night time discharges at this unit. Work continues to be undertaken locally to address these on going issues including QI projects, post ward round huddles, improving mean time to admission and focusing on stepping down non-level 2 patients earlier. The Board, with support from management, have begun planning a redesign of the current critical care structure as a whole.

2.2 Early discharges and readmissions

Figure 9 Early discharges in ICUs and combined units (2017)

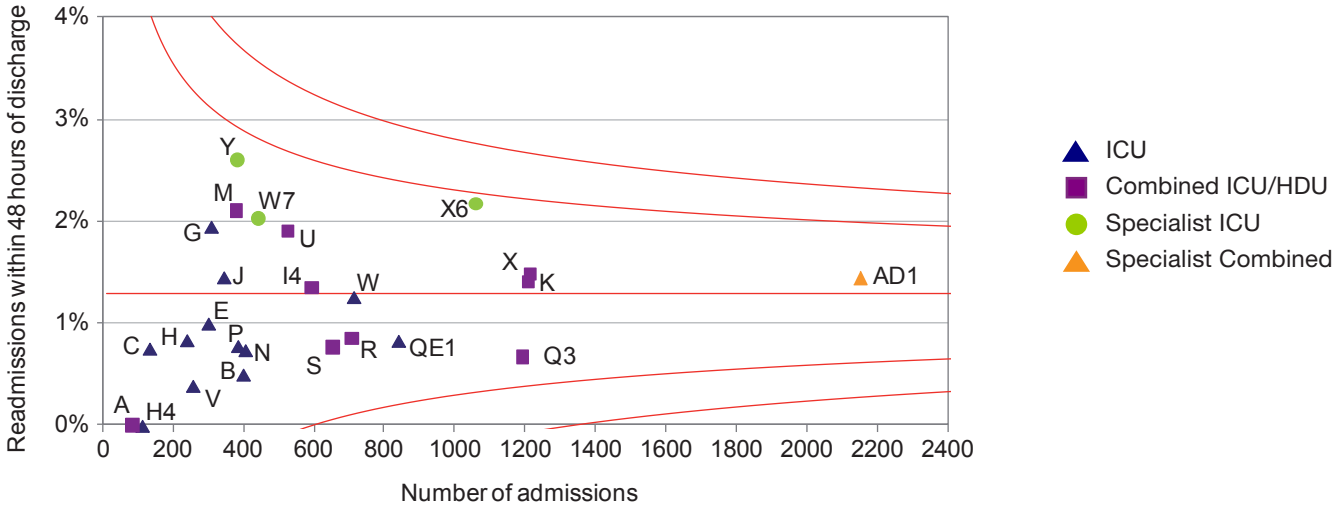


Note: Early discharge is defined as a transfer that is not in the best interest of a patient but necessary due to pressure on beds or staffing. From ICU, patients are usually discharged to another area in the hospital. The definitions have changed since 2016, with discharges to another area at the same level of care excluded from the figures.

The vast majority (over 90%) of patients that are marked as an early discharge from ICUs and combined units are discharged to another area in the hospital. The definition of an early discharge has been refined since last year, with movement to another unit at the same level of care not counted in the early discharge figures.

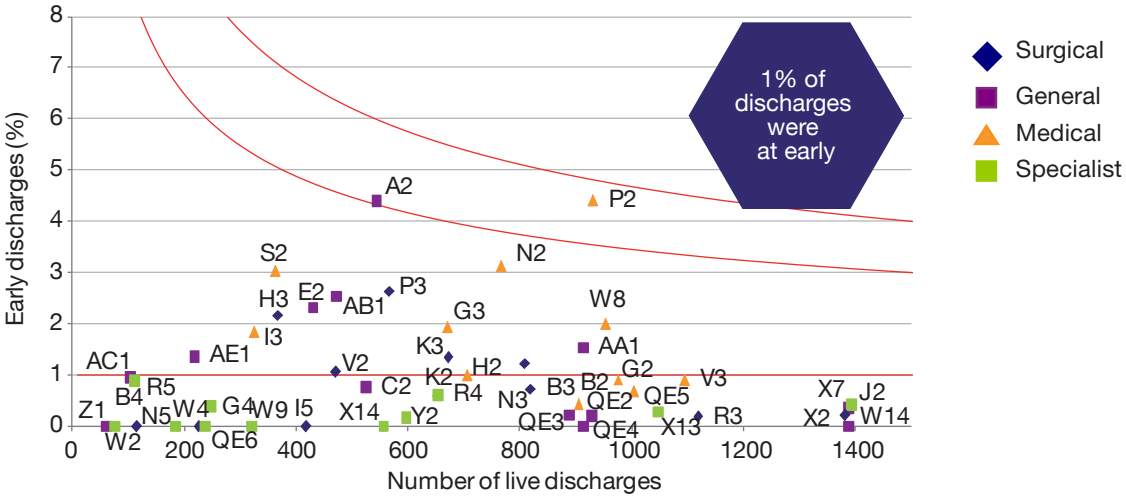
Unit N (NWD ICU) has the highest percentage of early discharges at almost 7%. The vast majority of these patients were discharged to a HDU or ward in the same hospital. This figure suggests that the number of physical ICU beds available at Ninewells hospital is inadequate to meet the demands of the service. At times of peak occupancy, ICU bed demand appears to exceed the supply and patients were discharged early to a lower level of care. The frequency of documented early discharges is more than 3 times the Scottish average, and it is an outlier to 2SD providing some evidence that it may be statistically significantly higher than the Scottish average.

Figure 10 Readmissions within 48 hours of discharge to ICUs and combined units (2017)



Unit Y (SGH NICU) had the highest percentage of readmissions to the same unit within 48 hours of discharge at just under 3% however, it is not an outlier. As the only stand-alone specialist neurological ICU we would expect a higher readmission rate compared to other ICUs in Scotland due to differing patient case-mix.

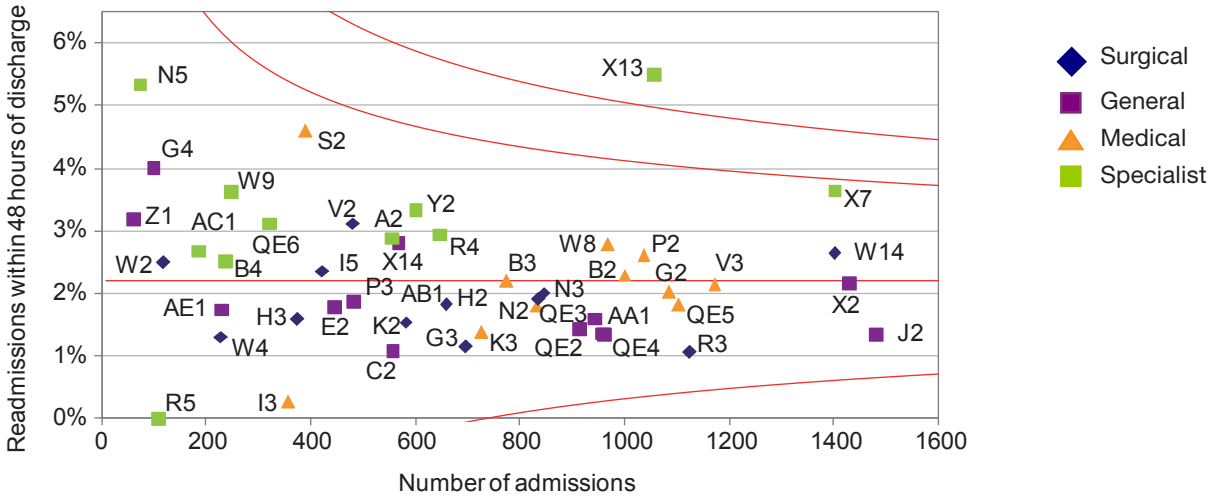
Figure 11 Early discharges in HDUs (2017)



The average percentage of early discharges in Scotland is 1%. Overall medical HDUs look to have a higher rate of early discharges than other HDUs in Scotland. Units A2 (IRH HDU) and P2 (RGM MHDU) have the highest rate of early discharge at almost 5%. Both these units are outliers on the funnel plot to 2SD providing some weak evidence, they are statistically higher than the Scottish average. The vast majority of patients discharged early were moved to a ward in the same hospital, this reflects the demand for HDU beds.

In order to facilitate access to Unit A2 (IRH HDU) there is a short turnaround time between admissions and discharges out with planned ward rounds therefore, outlying this variable may be a consequence of subjective data entry as it does not reflect clinical experience. The nursing staff have had extensive training in 2018 to support the improvement in the data entry and there appears no signal of harm to this patient group or evidence of critical incidents involving discharges from HDU.

Figure 12 Readmissions within 48 hours of discharge to HDUs (2017)



Just over 2% of admissions to HDUs were readmissions for patients that had been discharged from the unit less than 48 hours previously. Unit X13 (RIE RTHDU) had the highest readmission rate for HDUs, however it is known that this unit admits patients prior to their transplant who then return post transplant which may account for the higher readmissions rate.

2.3 Quality indicators and staffing summary

Table 1 Summary of ICUs and combined units compliance with SICSAG Quality Indicators

Table key

- Unit fully meeting this indicator
- Unit meeting this indicator in the majority of cases
- Unit meeting this indicator in some cases
- Unit is failing to meet this indicator

Unit Name	Daily consultant review and written management plan	Consultant-led twice daily ward rounds	Pharmacist	Tracheostomy communication and swallowing needs assessed in Critical care	Screening for Delirium in Critical Care	Rehabilitation needs in Critical Care	End of life care policy in place	Deaths and adverse events discussed at regular clinical governance meetings	A regular patient/family experience survey is undertaken in the unit
ARI ICU									
Ayr ICU									
Crosshouse ICU									
DGRI ICU									
IRH ICU									
Ninewells ICU									
PRI ICU									
QEU ICU									
RAH ICU									
Raigmore ICU									
VHK ICU									
Wishaw ICU									
BGH ICU/HDU									
FVRH ICU/HDU									
GJNH CICU/ CHDU									
GRI ICU / HDU									
Hairmyres ICU/ HDU									
MNK ICU/HDU									
RIE ICU/HDU									
SJH ICU/HDU									
WGH ICU/HDU									
SGH NICU									
ARI CICU									
RIE CICU									

Please note: The ICUs and combined units were fully complying with care bundles and physiotherapy staff quality indicators, therefore these are not shown on the table.

Table 2 Summary of HDUs compliance with SICSAG Quality Indicators

Table key

- Unit fully meeting this indicator
- Unit meeting this indicator for the majority of patients
- Unit meeting this indicator for some patients
- Unit is failing to meet this indicator
- Not relevant for this unit

Unit Name	Daily consultant review and written management plan	Consultant-led twice daily ward rounds	Pharmacist	Physiotherapist	Care bundles in place for; IAP, CVC, and PVC	Screening for Delirium in Critical Care	Rehabilitation needs in Critical Care	End of life care policy in place	Deaths and adverse events discussed at regular clinical governance meetings	A regular patient/family experience survey is undertaken in the unit
Ayr HDU										
Balfour HDU										
Belford HDU										
Dr Grays HDU										
GBH HDU										
IRH HDU										
PRI HDU										
QEU HDUs										
RAH HDU										
RIE HDU										
WIH HDU										
ARI MHDU										
Crosshouse MHDU										
DGRI MHDU										
GRI MDU										
Hairmyres MHDU										
MDGH MHDU										
Ninewells MHDU										
QEU MHDU										
Raigmore MHDU										
VHK MHDU										
Wishaw MHDU										
SGH NHDU										
WGH NHDU										
RIE RTHDU										
VHK RHDU										
RIE CHDU										
ARI OHDU[1]										
Ninewells OHDU[1]										
PRM OHDU[1]										
QEU OHDU[1]										
RIE OHDU[1]										

Unit Name	Daily consultant review and written management plan	Consultant-led twice daily ward rounds	Pharmacist	Physiotherapist	Care bundles in place for; IAP, CVC, and PVC	Screening for Delirium in Critical Care	Rehabilitation needs in Critical Care	End of life care policy in place	Deaths and adverse events discussed at regular clinical governance meetings	A regular patient/family experience survey is undertaken in the unit
ARI SHDU										
Crosshouse SHDU										
DGRI SHDU										
GRI SHDU										
MNK level 1 HDU										
Ninewells SHDU										
Raigmore SHDU										
VHK SHDU										
WGH SHDU										
Wishaw SHDU										

1. The following quality indicators are not appropriate for the obstetric HDUs; Screening for Delirium in Critical Care, Rehabilitation needs in Critical Care, End of life care policy in place.

MSQIs[2] are under the governance of SICSAG. These Standards and Quality Indicators are defined as being person centred, safe, effective, evidence based, equitable and timely and are in line with the 2020 Vision[1]. The indicators are, in many cases, aspirational and searching but they strive to meet these challenging criteria. For each of the standards and indicators, all outliers are subject to the SICSAG governance procedure. Each unit is given the opportunity to respond to each governance issue reported here for 2017 data and encouraged to develop an action plan for improvement.

The following are an example of responses from the governance process.

- GJNH ICU/HDU — Progress has been made in 2018 with an End of Life Care group focusing on Palliative Care, Bereavement and Tissue and Organ donation. There is an appointed member of nursing staff to lead the development of an End of Life pathway and this has already been successfully trialled in critical care over the last three months. The vision is to develop a coherent hospital wide strategy.
- MNK ICU/HDU — Pilot data was collected on best assessment for rehabilitation in 2017. With the aim to implement fully be the end of 2018.
- WGH NHDU — The unit uses the NHS Lothian Palliative Care Guidelines and have a close working relationship with the Palliative Care Team. End of life Care is not usually commenced in NHDU. This unit uses Tell Us Ten Things for feedback and the neurosurgical unit collates feedback through Care Opinion.

• RIE CICU/CHDU	Both units are managed by the same team and responses cover both units: All cardiac surgical M&Ms are discussed at the cardiac surgery M&M meetings and non-surgical issues are discussed at the anaesthetic morbidity and mortality meetings. A new M&M lead has been appointed for cardiac ICU and we plan to combine this in to a single cardiac ICU M&M meeting which will commence in September 2018. Patient and family/carer experience surveys are currently collected for the cardiothoracic unit as a whole using the "Tell Us Ten Things" questionnaire. We intend to use "Tell Us Ten Things" and Care Opinion specifically in the Cardiac ICU from August 2018. Currently the organisational end of life care policy is used in Cardiac ICU, but one specific to Cardiac ICU will be developed as a "Care Assurance Standard". Work on this will commence in August 2018. Screening for delirium in critical care has not been met in the CHDU. This is not common practice in specialist HDU's using accepted critical care delirium screening tools such as CAMICU. However, NHS Lothian does routinely screen all patients over 65 using 4AT and more detailed assessment where this reveals a positive result.
• DGRI ALL UNITS	All units merged in December 2017. Since the new amalgamated unit opened there are action plans in place for improvement across the indicators.
• VHK ALL UNITS	Since 2016, the pharmacy service at these critical care units have been severely curtailed such that cover is now restricted only to phone calls for advice and occasional pharmacy attendance in the unit to deal with specific queries. We do not have a pharmacist on the ward rounds in any of the units. This is a result of an inability to recruit into vacant positions. This issue has been highlighted as a serious concern with management and at the Scottish Critical Care Delivery Group meetings on many occasions. However, due to the recruitment issues surrounding pharmacists at this time, there has been no success in procuring any more pharmacy time for critical care.
• QEUH MHDU	Since the start of 2018, there is a regular Morbidity and Mortality process with all deaths reviewed.
• NWD MHDU	There is significant work ongoing to develop a tool for rehabilitation and an end of life care policy. The aim is to meet these indicators within the next 12 to 18 months.
• VHK MHDU	Since the start of 2018 the unit has instituted a continuous regular mortality review which is entered into an online database with feedback to clinical staff at their medical clinical governance meeting and any serious morbidity reported via DATIX/SAER system also be presented at these regular meetings.

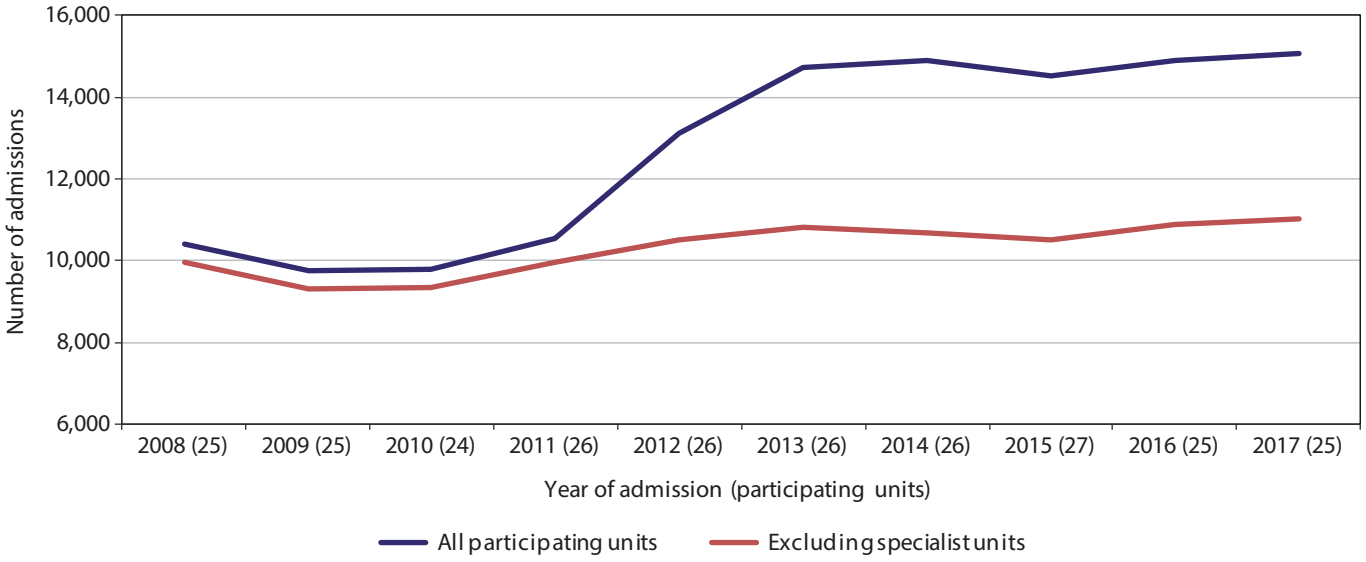
• RIE OHDU	At present, within the Obstetrics all patients who have had anaesthetic input are reviewed for potential morbidity and satisfaction with care. All HDU patients are clinically reviewed on the obstetric consultant ward round the following day. Recommendation: The obstetric anaesthetic HDU lead Dr A. Wise has plans in place to introduce a survey before the next SICSAG report (by March 2019).
• ARI OHDU	There is not a dedicated pharmacist attached on this unit but there is a dedicated pharmacist attached to the maternity hospital available anytime during working hours and on-call. There is not a dedicated physiotherapist due to the nature of admissions however, there is access to the physiotherapy when needed. The unit commenced patient/family experience surveys during 2018.
• PRM OHDU	Following investigative work and an action plan, changes have been implemented in this unit to meet the MSQI for a Pharmacist in Critical Care. A specialist pharmacist now visits the unit daily Monday to Friday and out of hours as provided similar to other critical care areas in the hospital.
• NWD OHDU	Since the start of 2018, patient and family feedback survey has been introduced.
• QEUH OHDU	In May 2018, this unit took action by having an inter-disciplinary meeting to discuss how to move forward with patient information leaflets and obtaining feedback from patients and family members about their experience. Approval for a new version of the patient information leaflet has now been given and these are currently being distributed in the unit. As of June 2018 patients have been given feedback forms to complete. A pilot study has been on going since analysing responses and some patients have been interviewed regarding their experience and thoughts about their stay in HDU. It is expected that this pilot & analysis will be completed before the end of 2018.
• ARI SHDU	The surgical HDU units merged in April 2017 therefore data for the new SHDU will not encompass the whole of 2017. The unit has also appointed a SCN to lead the development of our current patient/ family experience survey which has currently been in place since late 2017. Moving forward, we believe that for the 2018 data set, we will meet all current and future requirements to meet SICSAG standards. The Care Assurance Tool exercise involves the use of a standardised, formal and structured inspection document and is utilised throughout ARI. This Tool examines quality and care delivery including the scrutiny of written feedback received and also seeks to understand the expressed satisfaction opinions of staff, patients, carers and significant others.
• RIE RTHDU	This unit has undertaken patient satisfaction surveys in the past but the poor rate of returns made interpretation difficult and feedback was lacking. At the time of collecting this unit data for SICSAG in Nov 2017, we were exploring alternative survey options. We have recently re-started the “Tell us Ten Things” survey and will make this a regular occurrence.

Section 3 Activity

Data regarding critical care activity are presented in this section. These data are presented in a variety of formats; information on funnel plots is given in the methodology section of the SICSAG website at: www.sicsag.scot.nhs.uk

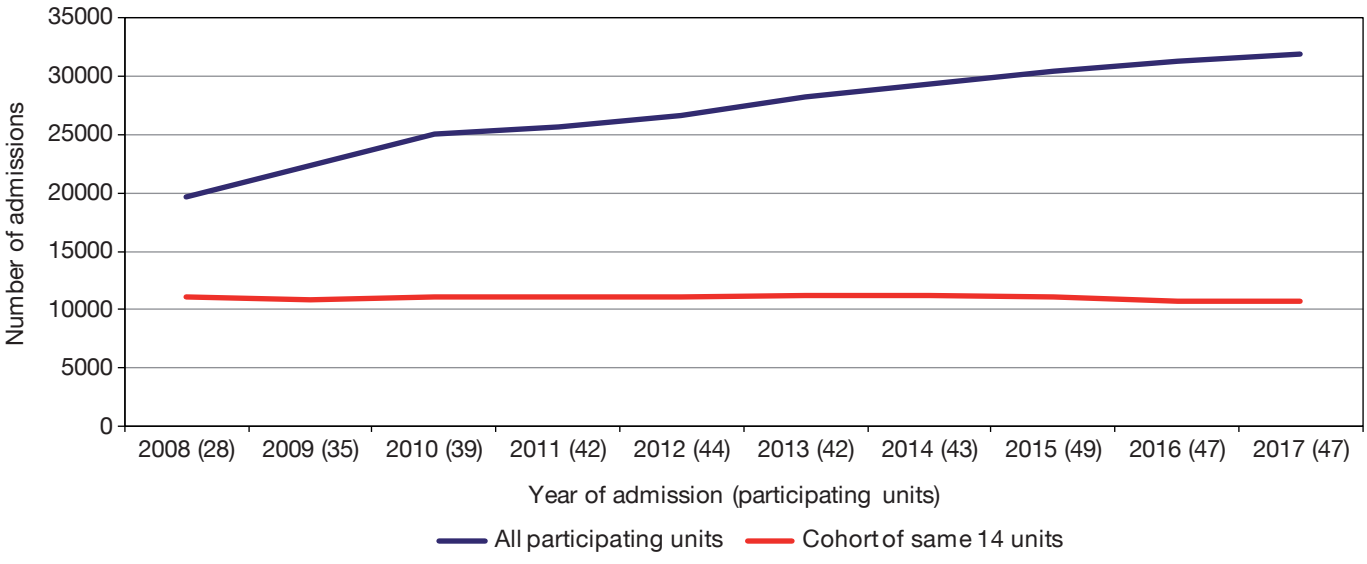
3.1 Number of admissions

Figure 13 Annual admissions to ICUs and combined units (2008-2017)



In 2017 there was a slight increase in admissions to ICUs and combined units compared to 2016, this equates to 1% more admissions. The red line shows ICUs and combined units excluding specialist units, which are ARI CICU, SGH NICU, RIE CICU and GJH CICU.

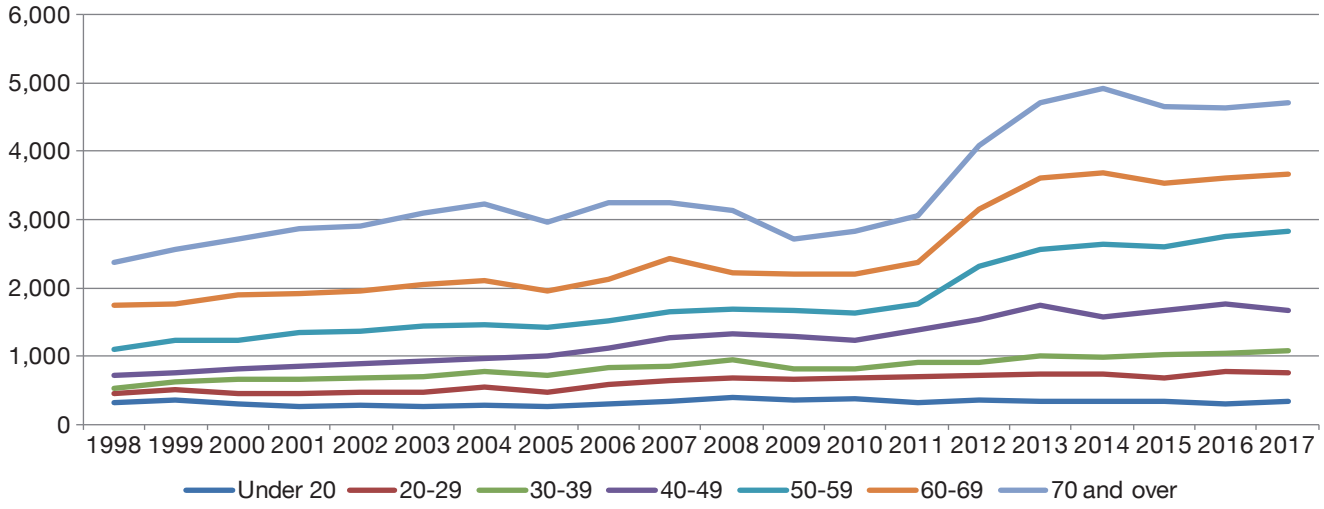
Figure 14 Annual admissions to HDU (2008-2017)



The number of admissions to HDUs increased by 2% from 2016 to 2017.

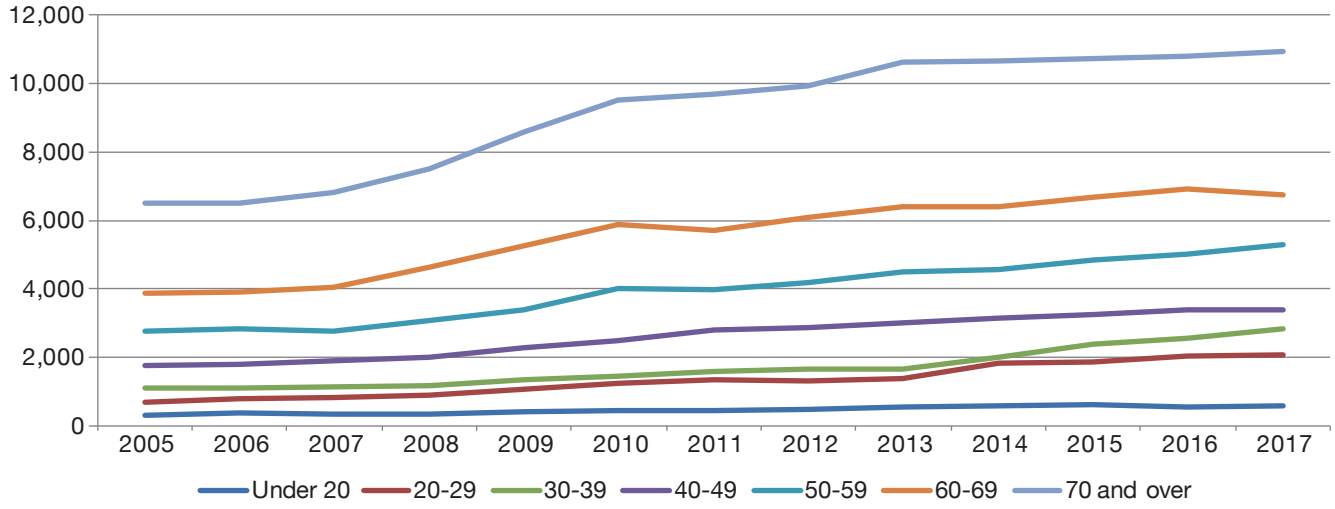
The cohort line refers to units that have participated in the audit for the past ten years, the number of admissions to these units has decreased slightly.

Figure 15 Age profile of patients admitted to ICUs and combined units (1998-2017)



The chart shows over time that there are a greater number of older patients being admitted to ICUs and combined units. It is noted that from 2011 there has been a greater increase in ages 70 and over, which is worthy of further investigation. Admissions per 100,000 of the over 70s population have increased from 485 in 2011 to 681 in 2016.

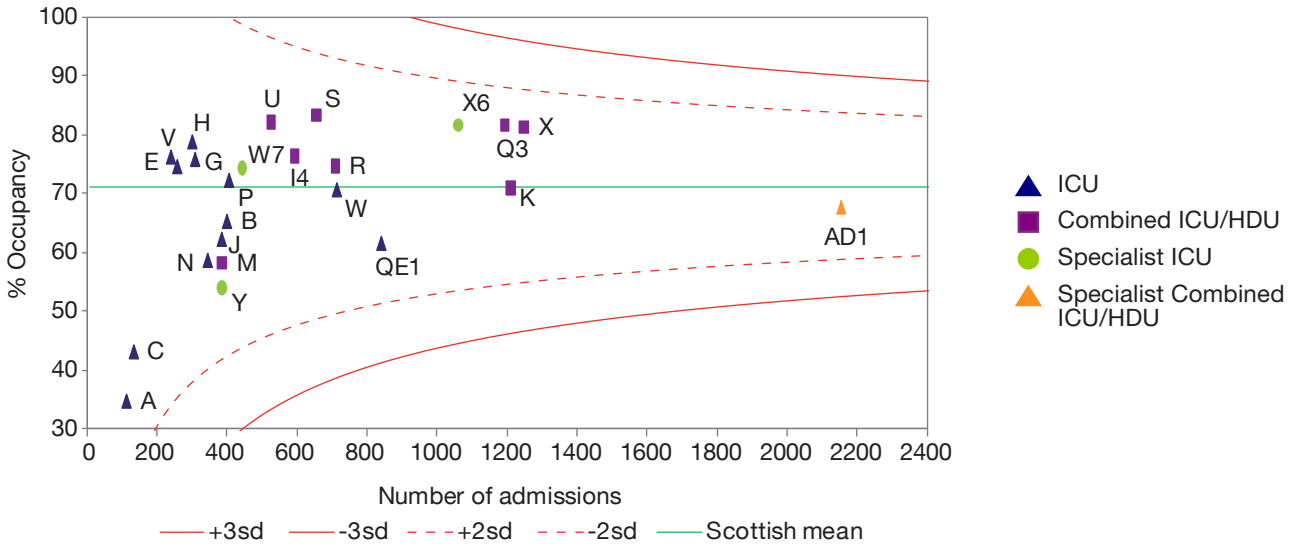
Figure 16 Age profile of patient admissions to High Dependency Units (2005-2017)



The chart shows over time the widening gap in admission numbers for HDUs between the age groups. There is a notable increase in the number of older patients while other age groups have stayed relatively static. Admissions per 100,000 of the over 70s population have increased from 1098 in 2006 to 1586 in 2016.

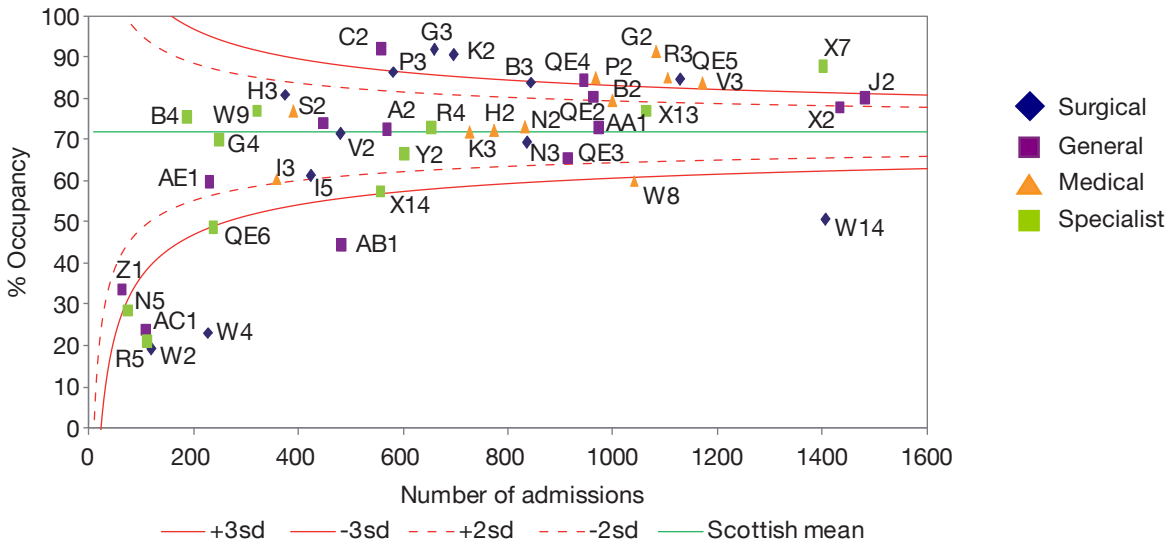
3.2 Bed occupancy

Figure 17 Bed occupancy rates for ICU and combined units (2017)



During 2017 the average occupancy in Scottish ICU and combined units was 67%. Unit S (HRM ICU/HDU), X6 (RIE CICU), X (RIE ICU), Q3 (FVH ICU/HDU) and I4 (MNK ICU/HDU) have all moved closer to Scottish mean compared to 2016.

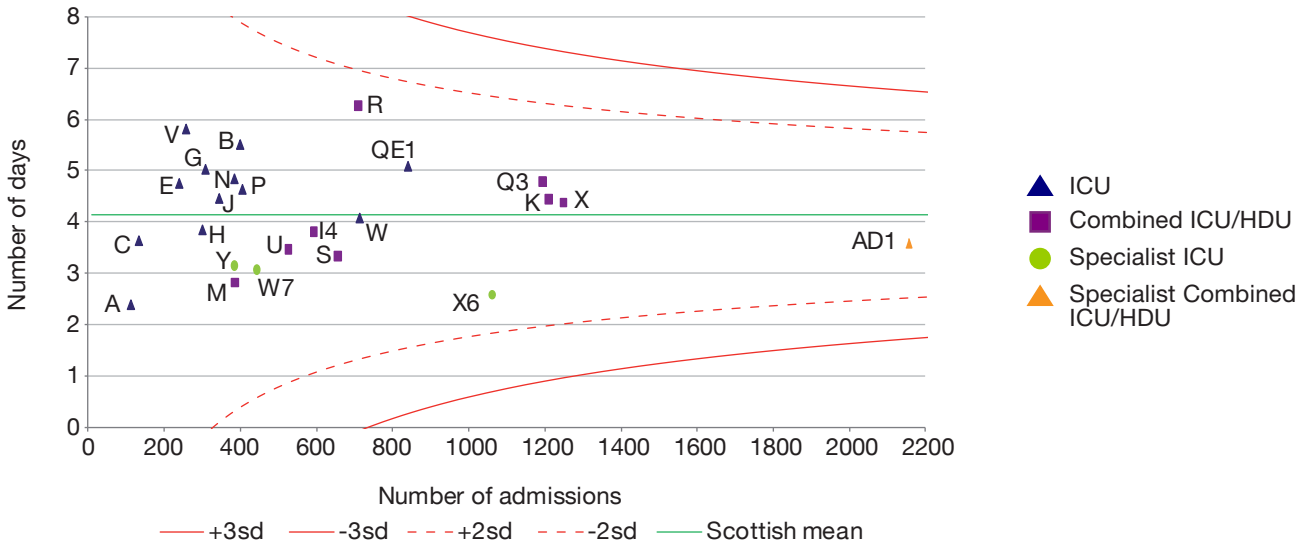
Figure 18 Bed occupancy rates for HDU (2017)



During 2017 the mean occupancy in HDUs was 72%. Compared to occupancy reported in 2016, units, B2 (VHK MHDU) P2 (PRI HDU) have moved from the mean to 3SD from the average, giving strong evidence that they have significantly higher occupancy than the Scottish mean in 2017, placing higher demands on the availability of HDU beds. Some of the units with low occupancy are in smaller remote hospitals and staff work within general wards until there is a need to open HDU beds.

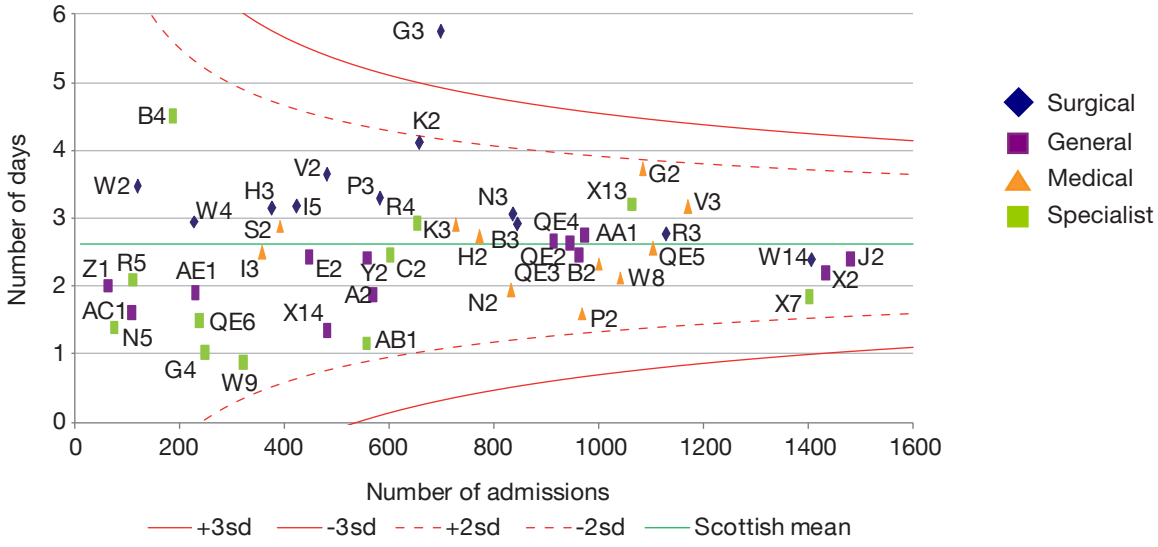
3.3 Length of stay

Figure 19 Mean length of stay in ICU and combined units (2017)



The mean length of stay for ICUs and combined units in 2017 was just over 4 days; which is similar to the last few years.

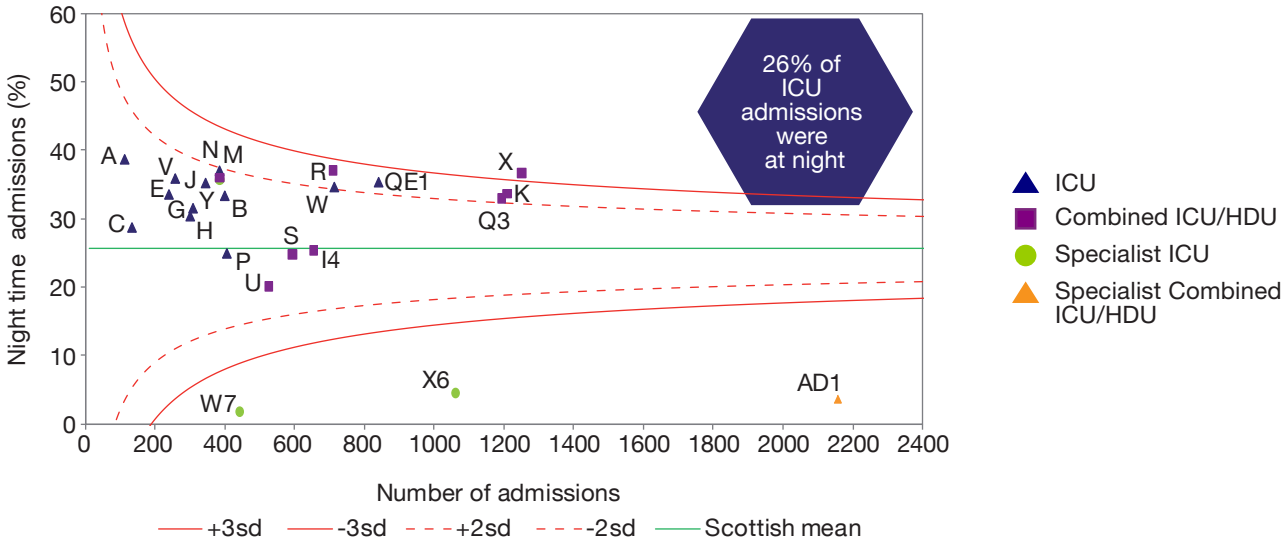
Figure 20 Mean length of stay in HDU (2017)



The mean length of stay in HDUs was the same as that reported over the last few years at just over 2 days. Unit G3, (CRH SHDU) had the longest average length of stay in a HDU at almost 6 days and is an outlier to 3 SD. This is an ongoing issue at this unit and has been an outlier on this chart for a number of years. This is due to a lack of available ward beds at the hospital.

3.4 Night time admissions

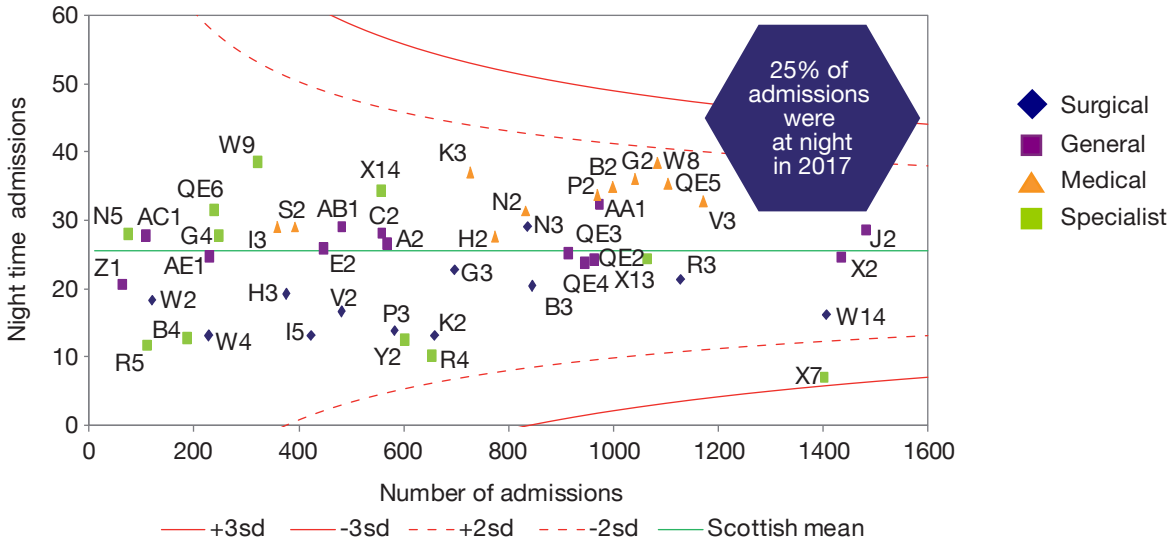
Figure 21 Night time admissions to ICU and combined units (2017)



Out of hours is defined as 10pm to 8am in line with the SICSAG Quality Indicators[2].

Unit X (RIE ICU/HDU) had significantly more night time admissions than the Scottish mean. All units with a significantly lower night time admission compared to the Scottish mean are specialist cardiothoracic units; W7 (ARI CICU), X6 (RIE CICU), AD1 (GJH CICU).

Figure 22 Night time admissions to HDU (2017)

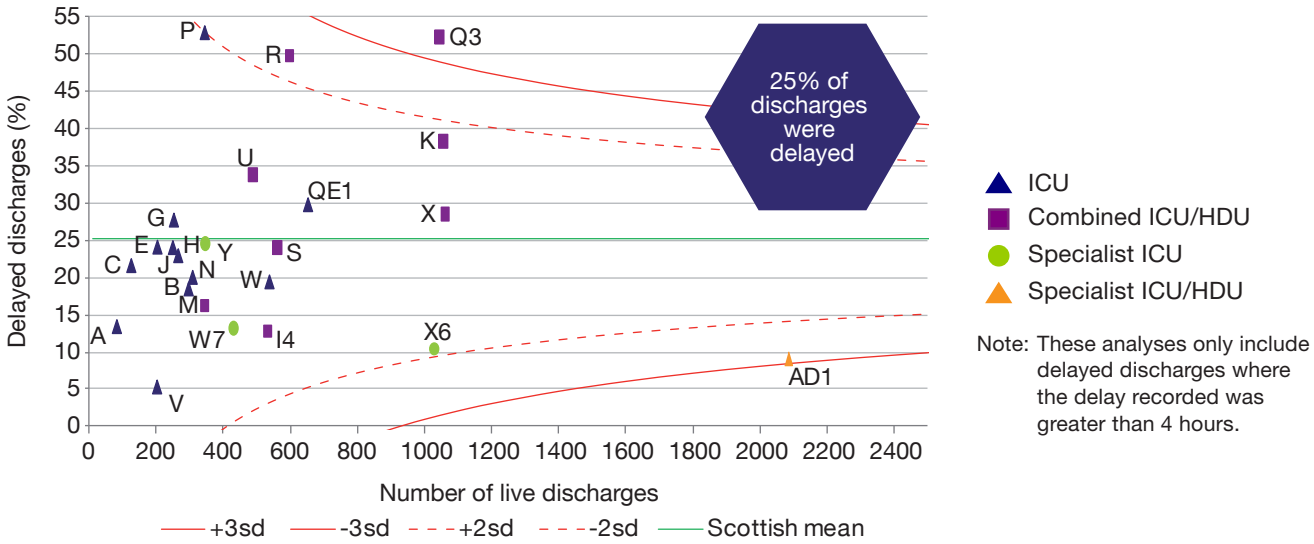


For 2017, 25% of admissions were at night. Please see Figures 7 and 8 for data on night time discharges.

3.5 Delayed discharges

Delayed discharges are instances where patients are deemed clinically ready for discharge, but there is a delay or "gap" before actual discharge. The most common reason for delayed discharge is a shortage of available ward or HDU beds. This in turn can be due to delayed discharge of patients from acute hospital beds, often caused by lack of social care in the community. In times of peak demand, this effect can back up into critical care areas.

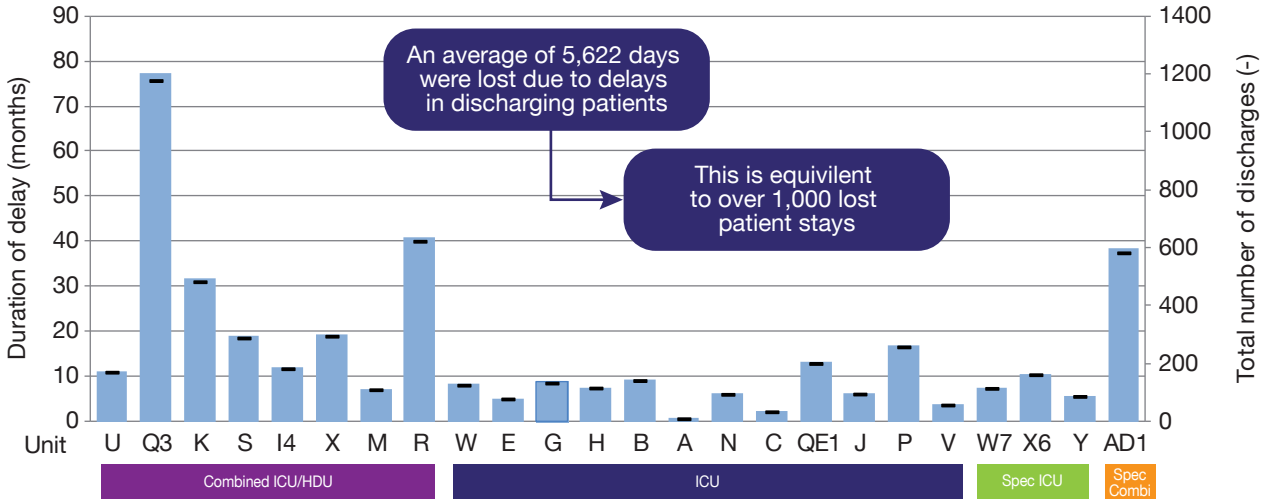
Figure 23 Delayed discharges of greater than 4 hours from ICU and combined units (2017)



Note: These analyses only include delayed discharges where the delay recorded was greater than 4 hours.

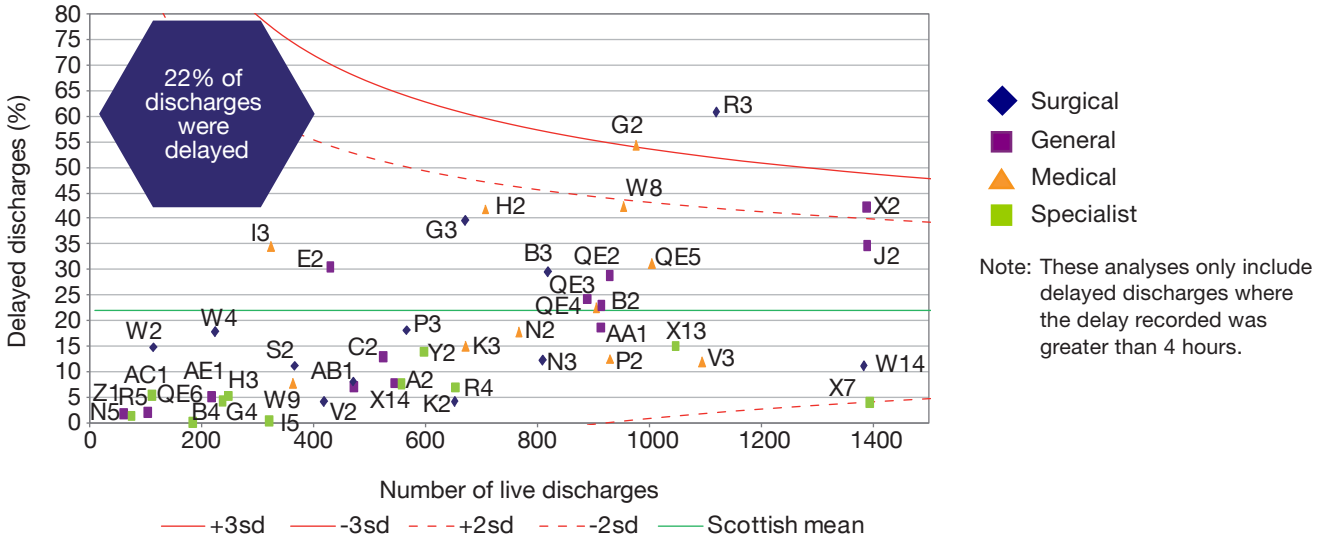
In 2017, 25% of discharges in Scotland had a delay in their discharge of over 4 hours. There is strong statistical evidence that Unit Q3 (FVH ICU/HDU) has significantly more delayed discharges compared to the Scottish average, with 52% of discharges having a delay of over 4 hours. They were also an outlier to 3SD in 2016. Unit R (WGH ICU/HDU) is showing weaker evidence of being significantly higher than the Scottish average. As with other ICUs in Scotland, the main reason for the delay is a lack of HDU or ward beds in the hospital.

Figure 24 Cumulative delayed discharges from ICU and combined units (2017)



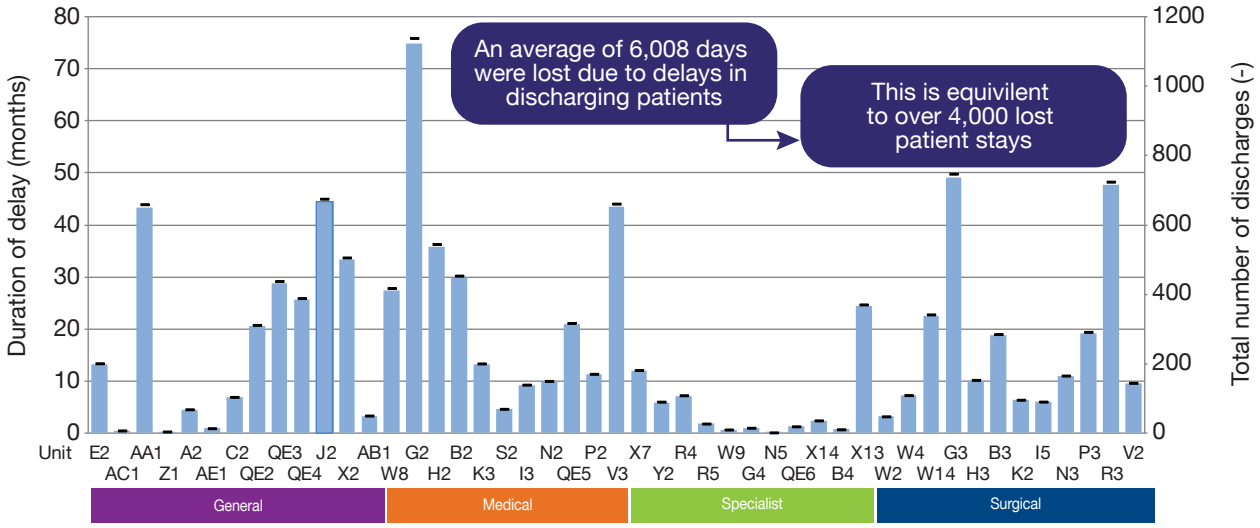
Unit Q3 (FVH ICU/HDU) had the highest cumulative discharges in ICUs and combined units. As seen in Figure 23, they are also an outlier for the number of delayed discharges of longer than 4 hours. This delay is mainly due to a lack of available ward or HDU beds at the hospital. Overall in Scotland, 5662 days were lost due to delays in discharging patients, this is equivalent to over 1,000 lost patient stays.

Figure 25 Delayed discharges of greater than 4 hours to HDUs (2017)



In 2017 22% of episodes in Scotland had a delay in their discharge of over 4 hours. Unit R3 (WGH SHDU) had significantly higher delayed discharges compared to the Scottish mean, with 60% of episodes having a delay of 4 hours or more. This is a reflection of the delayed discharges from the wards in this hospital. Unit G2 (CRH MHDU) had recorded 54% of episodes having a delay and appears in the funnel plot to be an outlier to 3SD. It is however an outlier to 2SD, providing weaker evidence that it is different from the Scottish average. Both of these units have the highest cumulative delayed discharge in 2017 (Figure 26) and both record 'Ward bed shortages' as the main reason for the delay. Crosshouse MHDU has an ongoing action plan to address bed flow problems.

Figure 26 Cumulative delayed discharges from HDUs (2017)



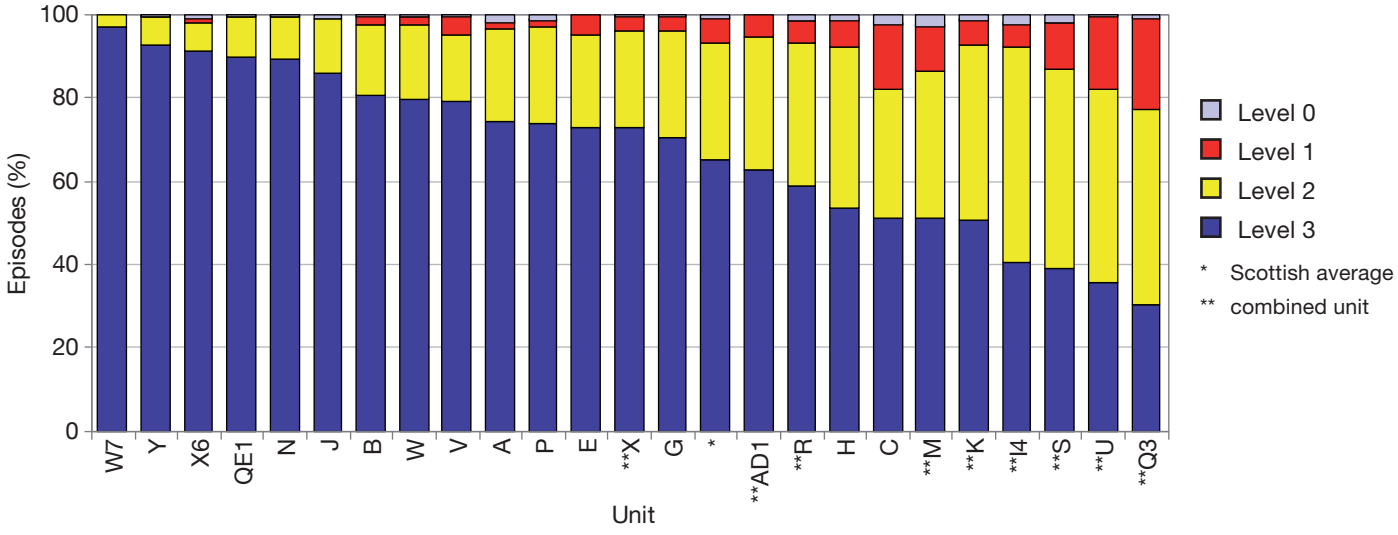
Unit G2 (CRH MHDU) had the highest cumulative delayed discharge for HDUs in Scotland. This was due to a lack of ward beds available. There is an ongoing action plan to address bed flow problems. Overall in Scotland, 6008 days were lost due to delays in discharging patients, this is equivalent to over 4,000 lost patient stays.

Section 4 Interventions

4.1 Level of care

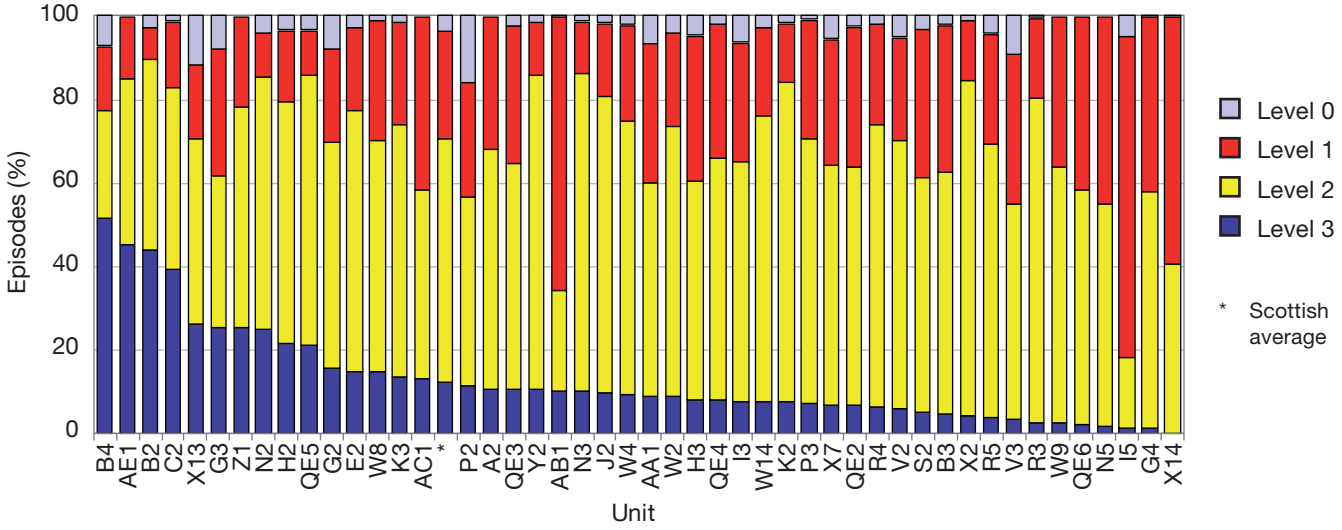
Level of care data are collected from the WardWatcher ACP page. It allows direct comparisons of interventions and levels of care to be made between critical care units. Some differences in the levels of care will be due to the differing specialty between hospitals. Level of care is defined in the methodology section of the SICSAG website (www.sicsag.scot.nhs.uk).

Figure 27 Highest level of care in ICUs and combined units (2017)



As in previous years the data are presented in order of descending proportion of level 3 care. In 2017 the highest level of care, level 3, was required in 64% of patient episodes in ICU and combined units and indicates the significant resource and skill-mix implications required by each unit in Scotland. Unit N (NWD ICU) and the specialist cardiothoracic and neurological units W7 (ARI CICU), X6 (RIE CICU) and Y (SGH NICU) have the highest percentage of patient episodes requiring level 3 care.

Figure 28 Highest level of care in HDU (2017)



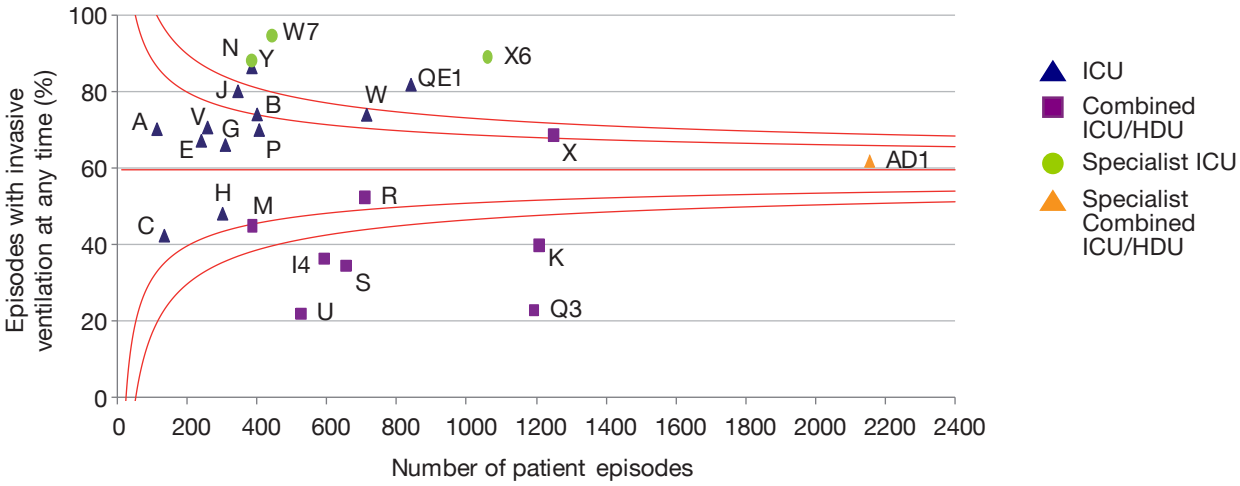
It is reassuring that this graph shows that the highest level of care required for the majority of HDU episodes is at the appropriate level (level 2), with 57% of patients at level 2 or higher. There is variation in the pattern of the highest level of care demonstrating the heterogeneous nature of HDUs.

B4 (VHK RHDU) has 52% of its patients at level 3 – it is a specialist renal HDU, therefore the vast majority of patients will have at least one organ supported everyday through RRT.

The proportion of HDU episodes requiring only level 0 (ward level) care has reduced this year from 6% in 2016 to 2% in 2017. The reduction is likely due to ongoing teaching and better understanding of the levels of care definitions in the units. Patients in critical care at level 0 likely represent downstream bed availability issues.

4.2 Respiratory support

Figure 29 Invasive ventilation at any time in ICU and combined units (2017)

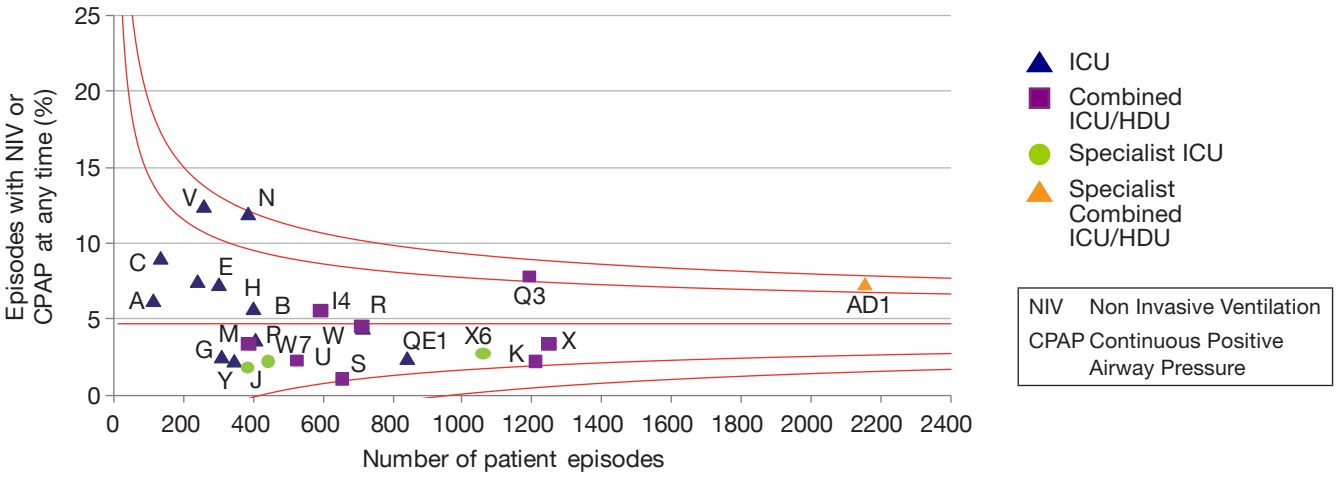


The Scottish percentage average of patients requiring invasive ventilation was 60% in 2017.

The Specialist units are again invasively ventilating a statistically significantly higher number of patients but this is entirely appropriate. ICU Units N (NWD ICU) and QE1 (QEU ICU) are both 3 SD above the Scottish mean, which may reflect units with inadequate bed capacity for their needs. Both these units also have high numbers of level 3 patients.

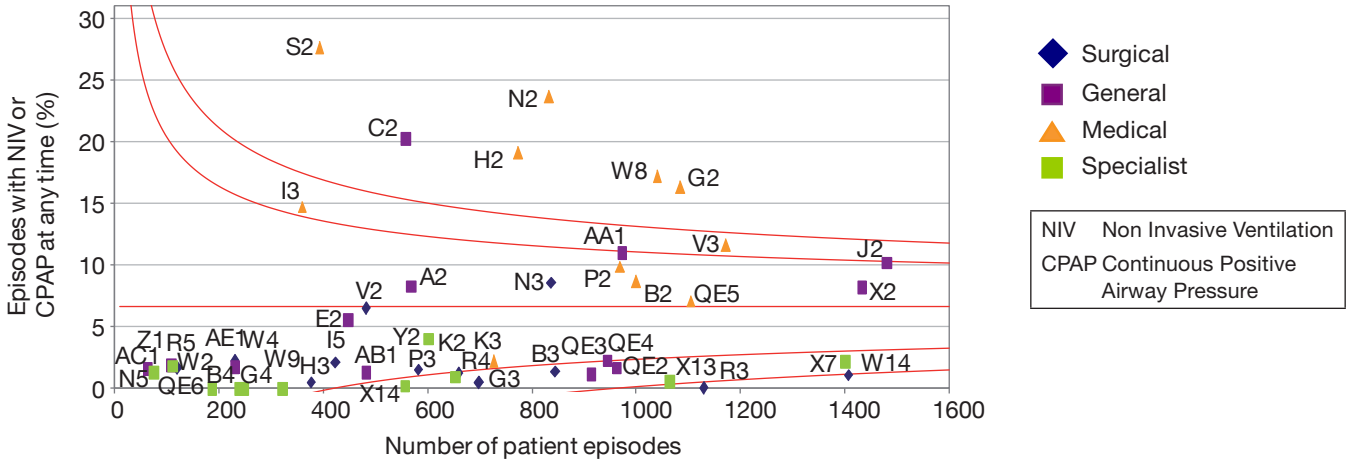
The lower area of the graph is dominated by the combined units where the case mix is generally more level 2 and level 3 patients.

Figure 30 NIV and CPAP rates in ICU and combined units (2017)



The incidence of this method of respiratory support remains low in ICU and combined units, at around 5% in 2017, with combined units dominating the lower part of the chart.

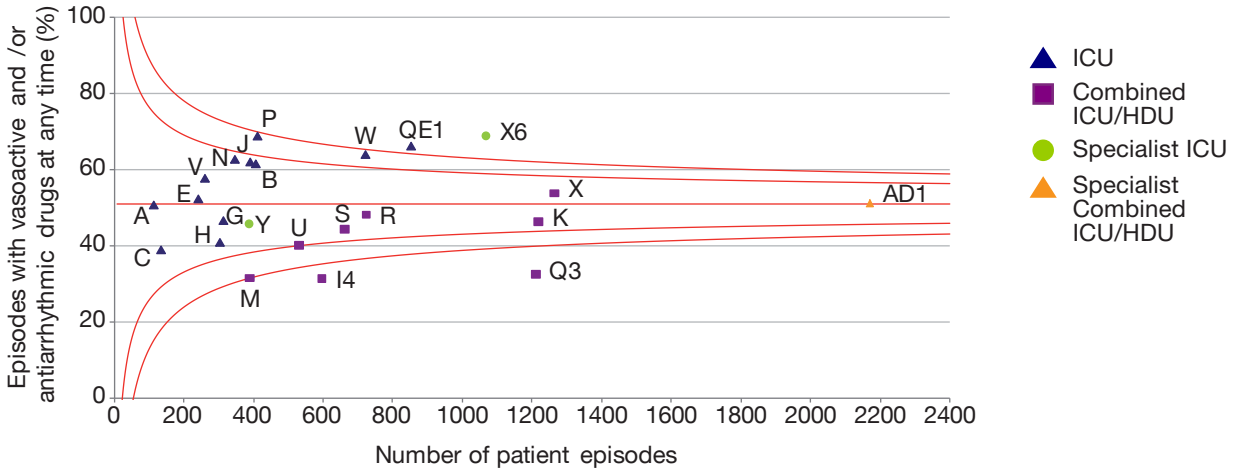
Figure 31 NIV and CPAP rates in HDU (2017)



The proportion of admissions to HDU who received NIV and/or CPAP has remained the same since 2012 at 7%. The top of the chart is dominated by medical HDUs as would be expected, with 5 out of the 6 3SD unit outliers being medical HDUs. Unit C2 (PRI HDU) is a combined unit but with a profile heavily toward medical admissions.

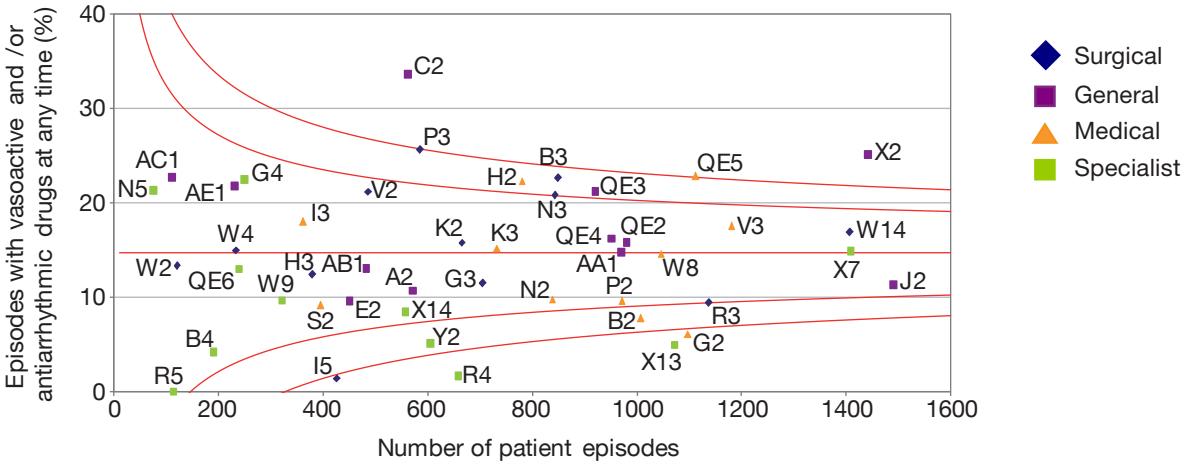
4.3 Cardiovascular support

Figure 32 Use of vasoactive and/or antiarrhythmic drugs in ICU and combined units (2017)



The proportion of patient episodes with vasoactive and/or antiarrhythmic drugs in ICU and combined units in 2017 is 50%, similar to the percentage reported in previous years. General Unit QE1 (QEU ICU) appears different in this respect from the other general units in Scotland for the first time. This could be due to an increase in admissions with a sepsis diagnosis from 13% in 2016 to 22% in 2017. X6 (RIE CICU) is a specialist CICU.

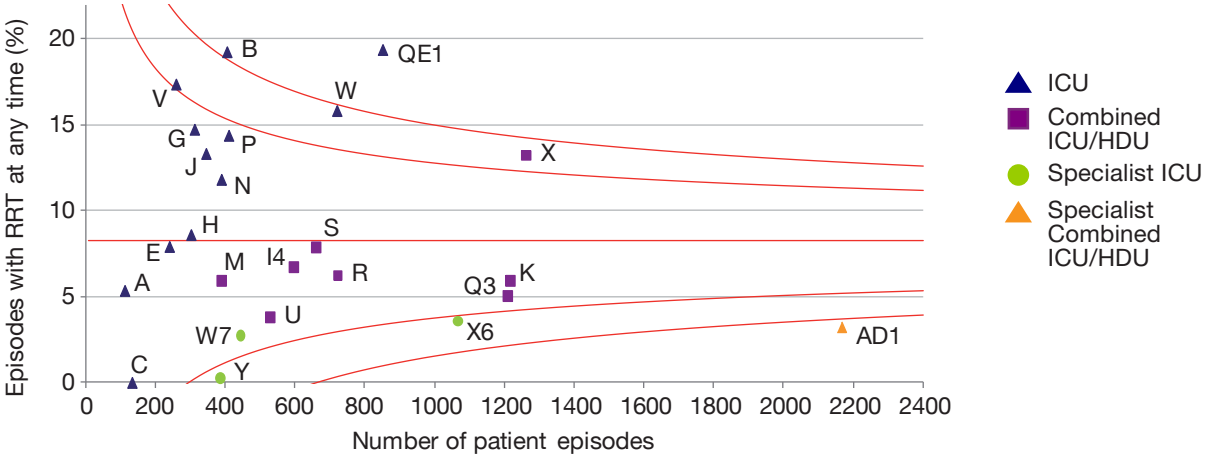
Figure 33 Use of vasoactive and/or antiarrhythmic drugs in HDU (2017)



Use of vasoactive and/or antiarrhythmic drugs in HDU has remained at a similar level to last year at 15%. Unit C2 (PRI HDU) is an outlier for the use of vasocative and/or antiarrhythmic drugs this year demonstrating improved data collection and the nature of their case mix being predominately medical patients and with a significant number of sepsis diagnosis.

4.4 Renal support

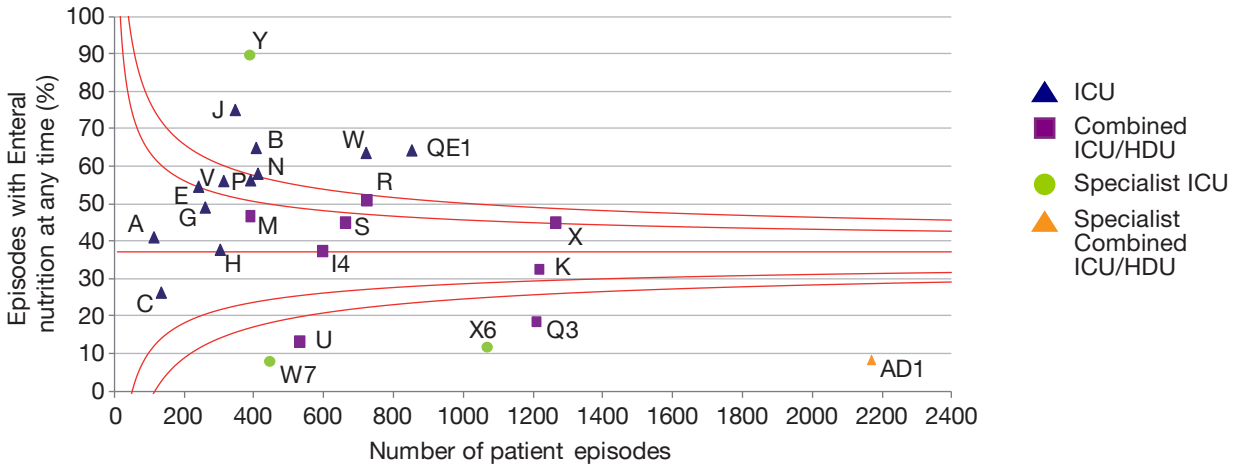
Figure 34 RRT in ICUs and combined units (2017)



The provision of RRT across Scotland appears static at 8% since 2014. Units QE1 (QEU ICU) and B (VHK ICU) have significantly more episodes with RRT compared to the Scottish mean. Unit B have been an outlier on this chart for a number of years, reflecting different practice in the NHS Board for RRT. There is no evidence to suggest that differences in practice for RRT have any impact on outcomes.

4.5 Nutrition

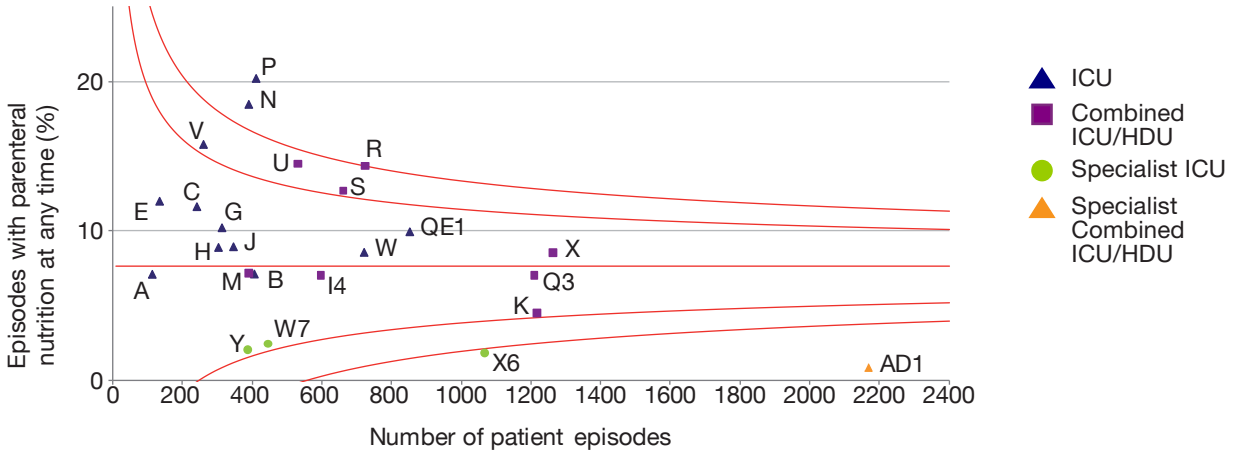
Figure 35 Enteral nutrition in ICU and Combined Units (2017)



Whilst there is a large amount of literature on ICU nutrition, there are relatively few large high quality trials. Guidelines have been produced by several networks, such as The Intensive Care Society and NICE, which were created following extensive search of the literature and determining the strength of the various recommendations by panels of experts. Key recommendations from SICS include that critically ill patients should be fed, preferably enterally, within 24 hours of admission and if enteral feeding fails or is contraindicated, parenteral nutrition should be considered early, but only in the malnourished patient with every effort being made to avoid breaks in delivery of nutrition[7].

The provision of enteral nutrition in Scotland ICUs was 37% in 2017.

Figure 36 Parenteral nutrition in ICU and combined units (2017)



The provision of parenteral nutrition in Scotland ICUs was 8% in 2016. General Units P (RGM ICU), N (NWD ICU) and R (WGH ICU/HDU) appear different than other units in Scotland with a higher rate of parenteral nutrition. At Raigmore ICU the nature of the GI surgery at this unit suggests a higher use of parenteral feeding over nasogastric feeding.

Enteral and parenteral nutrition have been reported for the past few years. These are not part of any quality indicators but by reporting here this should help inform future consultation and developing a quality indicator for nutrition in critical care.

Section 5 Surveillance of HAI in Intensive Care Units

5.1 Data collection and patient population

Data collected for the national HAI surveillance programme are presented in this section. Surveillance data were collected from adult patients (16 years or over) admitted to participating ICUs between 01/01/2017 and 31/12/2017, with a stay of more than two days. It is noted that this represents a different patient population than that presented in the other sections of this report.

All infections reported were identified in accordance with the European Centre for Disease Prevention and Control (ECDC) surveillance case definitions[8]. For the purpose of this report, all units including the combined units will be referred to as an ICU.

In 2017, a total of 22 units submitted data to the national ICU surveillance programme. Where year on year comparisons are made, these must be interpreted with caution as changes at individual units may result in an altered case-mix. During 2017, two units at Dumfries and Galloway Royal Infirmary merged and Ayr Hospital resumed data collection.

The variables which are used to determine whether pneumonia and bloodstream infections (BSI) are device associated have been redefined to provide more robust measures of device use around the time of HAI and to align to ECDC methods for analysis[9]. Data collected on the Ward Watcher ACP screen are now used to determine device use around the time of infection rather than specific questions relating to device use.

Healthcare Associated Infections (HAI)

All HAI are defined in accordance with the ECDC case definitions for HAI in ICU[1].

Bloodstream Infection (BSI)

BSI with positive blood culture(s).

Central Line-Associated Bloodstream Infection (CLABSI)

Patient had a BSI and a central line was in place for at least two days at the day of onset and the onset was at the latest on the second calendar day after first exposure to the central line.

Catheter Related Infection (CRI)

CRI-1: Local infection, pus/inflammation at the insertion site with microbiological evidence.

CRI-2: General CRI, microbiological evidence and clinical symptoms improve on removal of catheter line.

CRI-3: Microbiologically confirmed CLABSI

Ventilator Associated Pneumonia (VAP)

Pneumonia where an invasive device was present preceding infection, the pneumonia must occur at least one calendar day after intubation (to exclude cases where intubation was used in the treatment of pneumonia) and within two days following the end of intubation.

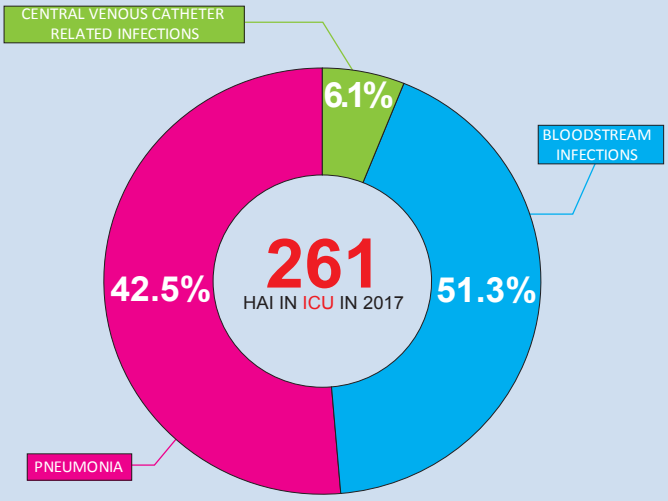
Pneumonia (PN)

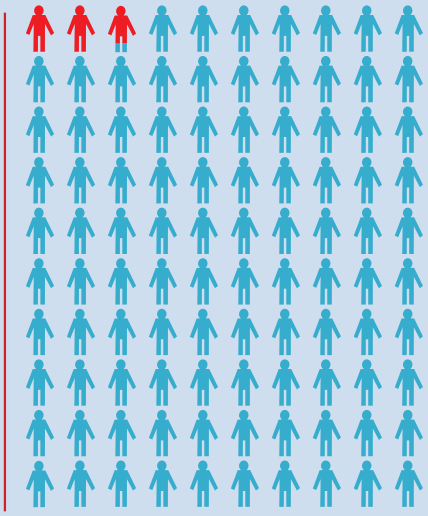
Pneumonia where a patient has not been ventilated within the time parameters defined by VAP.

HAI in Intensive Care Units

PREVALENCE OF **HAI** IN **ICU** IS HIGHER THAN IN OTHER AREAS WITHIN THE ACUTE SETTING, THIS PATIENT GROUP IS AT **INCREASED RISK OF INFECTION**, THEREFORE **HAI IN ICU** IS A PRIORITY FOR SURVEILLANCE.

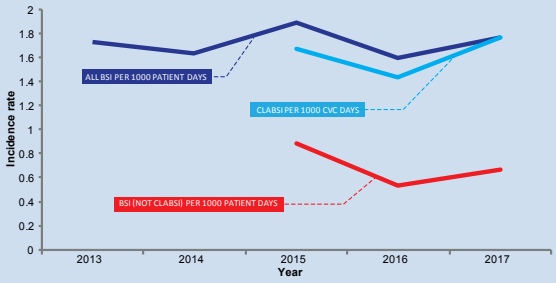
RELATIVE FREQUENCY OF HAI TYPE COLLECTED DURING 2017



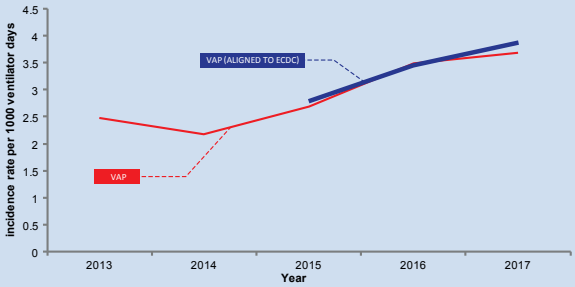


2.7% INCIDENCE OF HAI IN ICUs IN 2017.

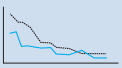
RATES OF BSI FROM 2013 TO 2017



INCIDENCE RATE OF VAP FROM 2013-2017



QUALITY IMPROVEMENT AND INTERVENTIONS TO REDUCE HAI IN CRITICAL CARE



- THE INCIDENCE OF **HAI IN ICU** REMAINS AT A SIMILAR LEVEL TO THAT REPORTED IN **2016**.
- UNITS SHOULD FOCUS ON **ENSURING DATA QUALITY** AND **DATA COMPLETNESS**.

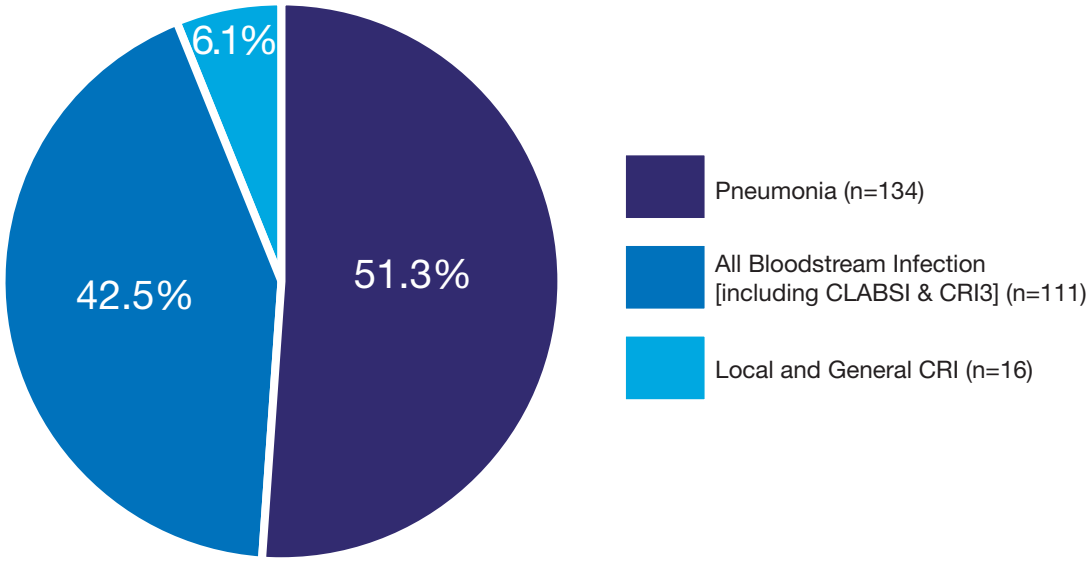
Health Protection Scotland

NHS National Services Scotland

5.2 The epidemiology of HAI in intensive care

Data were collected from 8729 admissions to ICU and in total 261 infections were reported from 234 ICU admissions (2.7%, 95% Confidence Interval (CI): 2.4-3.0). As shown in Figure 37, 51.3% of infections were PN, 42.5% were BSI and 6.1% were Local and General CRI.

Figure 37 Percentage of each HAI type reported (n= 261)



Pneumonia

A total of 134 pneumonia were reported from 131 admissions (1.5%, 95% CI: 1.3-1.8) and the incidence of all pneumonia was 2.1 per 1000 patient days. A total of 126 (94.0%) were considered to be VAP ¶ and the remaining eight (6.0%) had no invasive respiratory device present preceding the onset of infection. The incidence rates for pneumonia are summarised in Table 3.

Table 3 Incidence of pneumonia

Pneumonia	Number (%) of pneumonia	Incidence (95% Confidence Intervals)
VAP¶	126 (94.0)	3.9 per 1000 invasive device days (3.2-4.6)
Non-VAP	8 (6.0)	0.1 per 1000 patient days (0.1-0.3)
All	134 (100)	2.1 per 1000 patient days (1.8-2.5)

¶ Pneumonia must occur at least one calendar day after intubation (to exclude cases where intubation was used in the treatment of pneumonia) and within two days following the end of intubation to be defined as a VAP[9].

Bloodstream Infections (BSI)

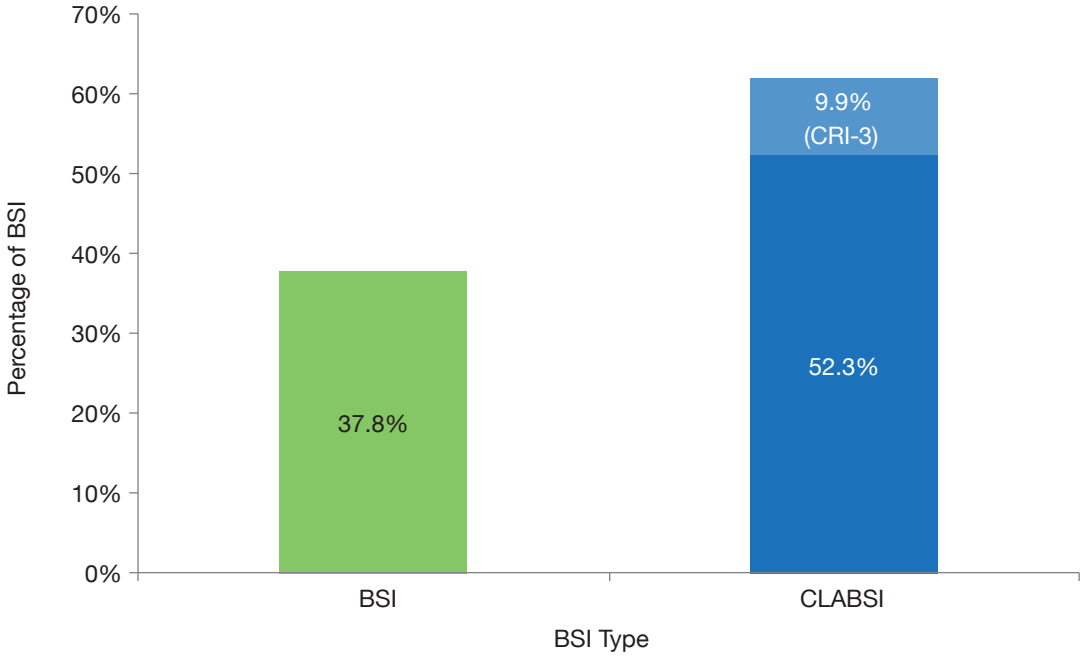
A total of 111 BSI were reported from 101 admissions, (1.2%, 95% CI: 1.0-1.4) and the incidence of all BSI was 1.8 per 1000 patient days (95% C.I: 1.5-2.1). Of the BSI reported, 69 (62.2%) were CLABSI and CRI3, and the incidence was 1.8 per 1000 central venous catheter (CVC) days (95% C.I: 1.4-2.2). Of the remaining 42 BSI, 22 (52.4%) were reported as secondary BSI (the same micro-organism was isolated from another infection site). Table 4 shows the incidence of BSI by type and Figure 38 shows the relative proportions of BSI and CLABSI.

Table 4 Incidence of BSI

BSI Type	Number of BSI (%)	Incidence (95% Confidence Intervals)
CLABSI * [BSI* + CRI3]	69 (62.2) [58+11]	1.8 per 1000 CVC days (1.4-2.2)
BSI	42 (37.8)	0.7 per 1000 patient days (0.5-0.9)
All BSI	111	1.8 per 1000 patient days (1.5-2.1)

* A patient with a BSI must have a central line in place for at least two days at the day of onset and the onset must be, at the latest on the second calendar day after first exposure to the central line or CRI-3 must be reported for the BSI to be defined as a CLABSI[9].

Figure 38 The relative proportions of BSI and CLABSI



CVC related infection (not including CR-BSI)

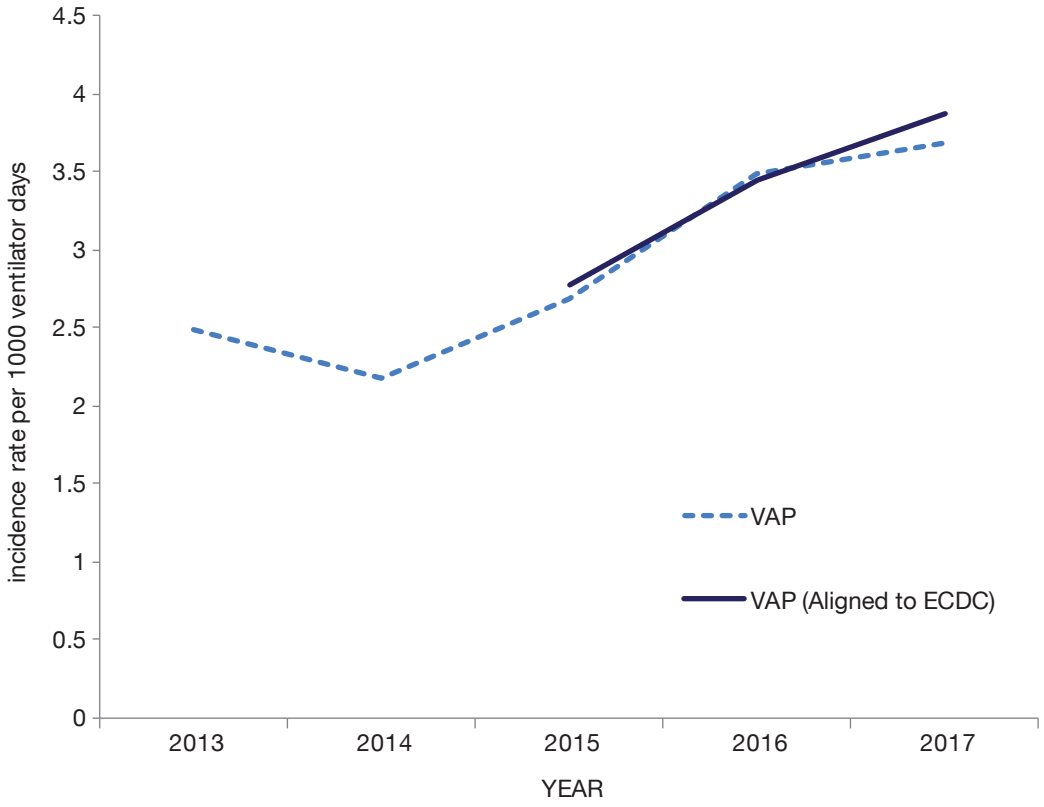
In total, two CRI-1 and 14 CRI-2 were reported, the incidence density of CRI-1 and CRI-2 was 0.4 per 1000 CVC days, (95% CI: 0.2-0.7).

Year on Year Comparison of Incidence

A total of 2.7% of ICU admissions developed an HAI during their stay in ICU. This remains unchanged from 2016.

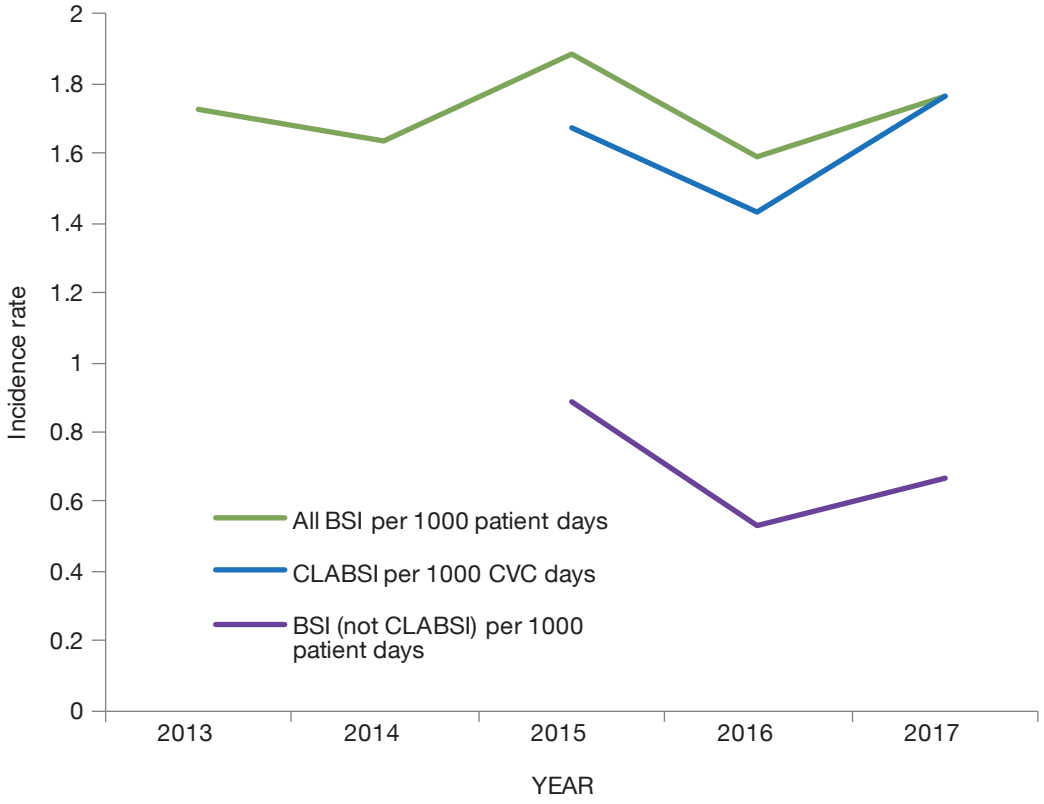
Incidence rates of VAP (aligned to the ECDC methodology for analysis[9]) for 2015 - 2017 are shown in Figure 39. The rate of VAP from 2013 - 2017 (as previously defined) is shown by the dashed blue line. Analyses of these data show that VAP has increased between 2015 and 2017 (p=0.02), but there has been no increase between 2016 and 2017 (p=0.7).

Figure 39 Incidence rate of VAP from 2013-2017



Incidence rates of BSI for 2013 - 2017 are shown in Figure 40, the rate for all BSI (includes all BSI, CLABSI and CRI3) is shown by the green line. The CLABSI rate for 2015 - 2017 (aligned to the ECDC methodology for analysis[9]) is represented by the blue line and BSI which do not meet the ECDC definitions for CLABSI are represented by the purple line.

Figure 40 Rates of BSI from 2013 to 2017



Analysis of these data show that the incidence and rates of HAI have not changed between 2016 and 2017, however here has been a statistically significant increase in VAP between 2015 and 2017 (p=0.02).

Year on year comparison of micro-organisms isolated from HAI

The distribution of the top ten organisms isolated from pneumonia and BSI in 2017 and the corresponding distribution of these organisms in 2016 are shown in Figures 41 and 42. The number of organisms is small and therefore any variation should be interpreted with caution.

Figure 41 The distribution of the top ten micro-organisms isolated from pneumonia in 2017 and the corresponding distribution of these organisms in 2016

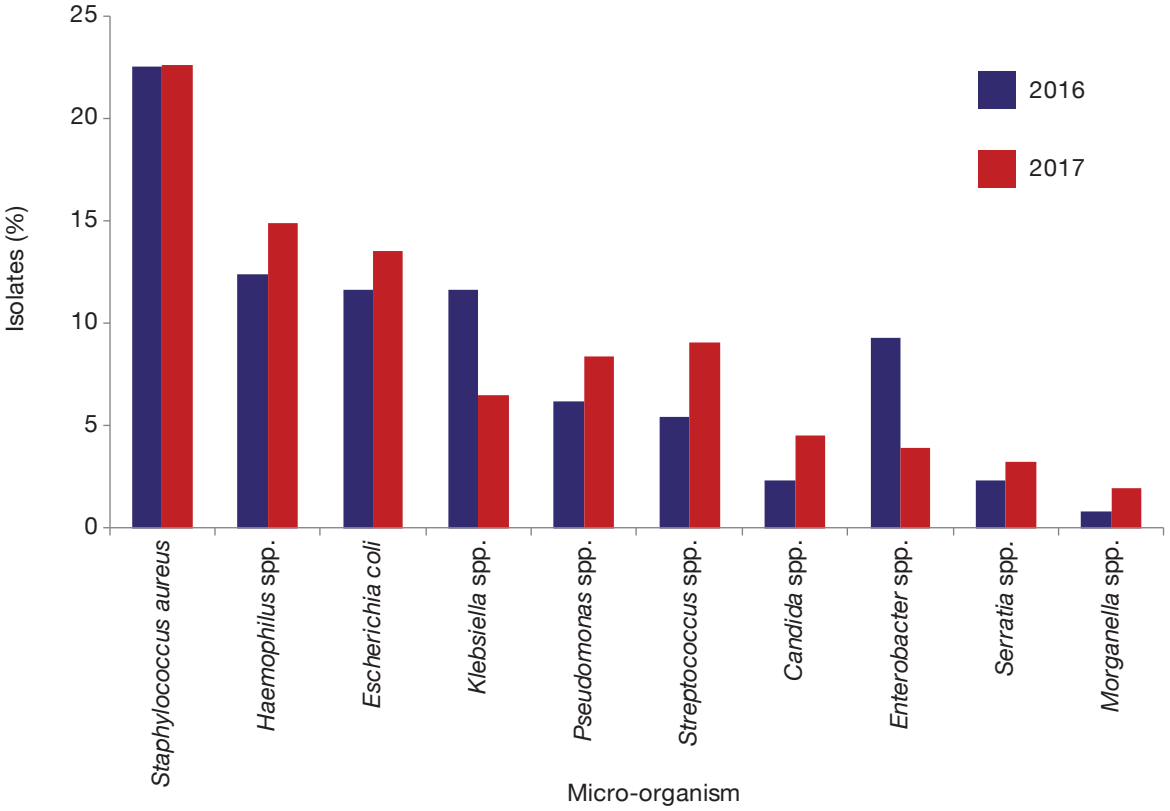
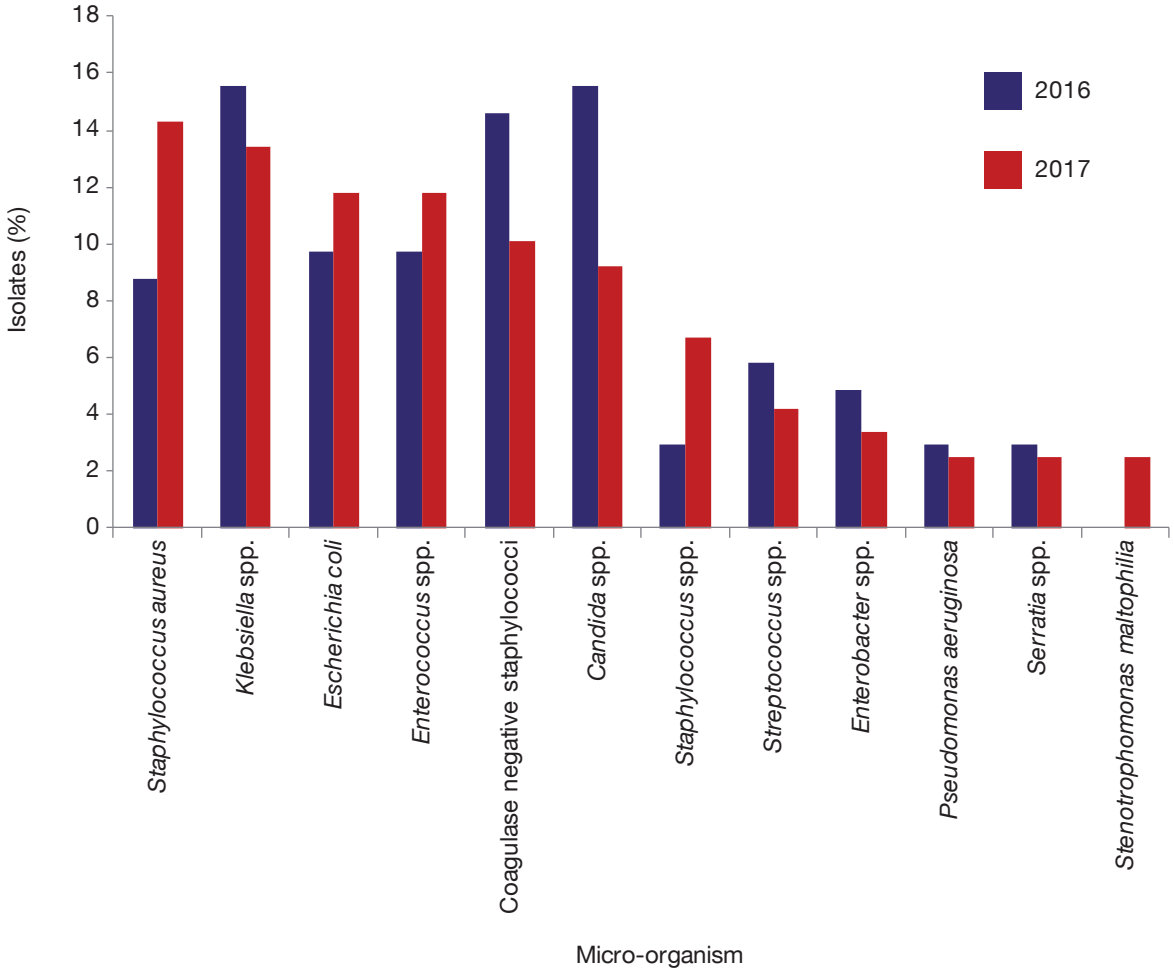


Figure 42 The distribution of the top ten micro-organisms isolated from BSI in 2017 and the corresponding distribution of these organisms in 2016



Antimicrobial Resistance Data

Antimicrobial resistance (AMR) patterns for a number of micro-organisms (limited to certain organism and antimicrobial combinations) are reported through the surveillance system. Overall, AMR data was available from 29.2% (n=80) of all isolates reported from all HAI.

AMR data for all Enterobacteriaceae and *Staphylococcus aureus* isolates from pneumonia and BSI are shown below in Figures 43 and 44. The number of individual organisms reported is very small and therefore we are unable to draw any conclusions relative to AMR in intensive care. This highlights the need to ensure that data are complete across the surveillance dataset.

Figure 43 AMR phenotype of Enterobacteriaceae isolated from BSI (n=38) and pneumonia (n=49)

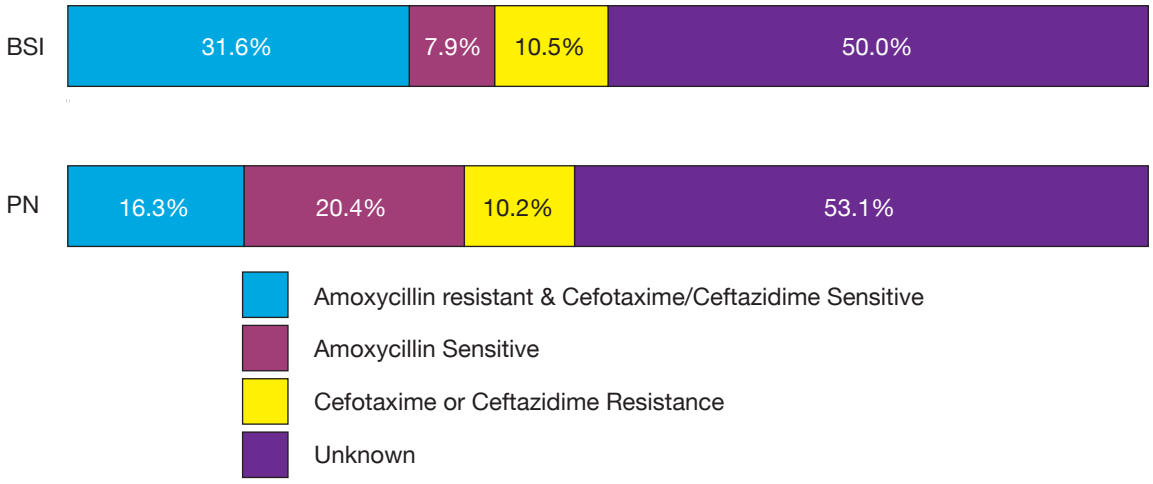
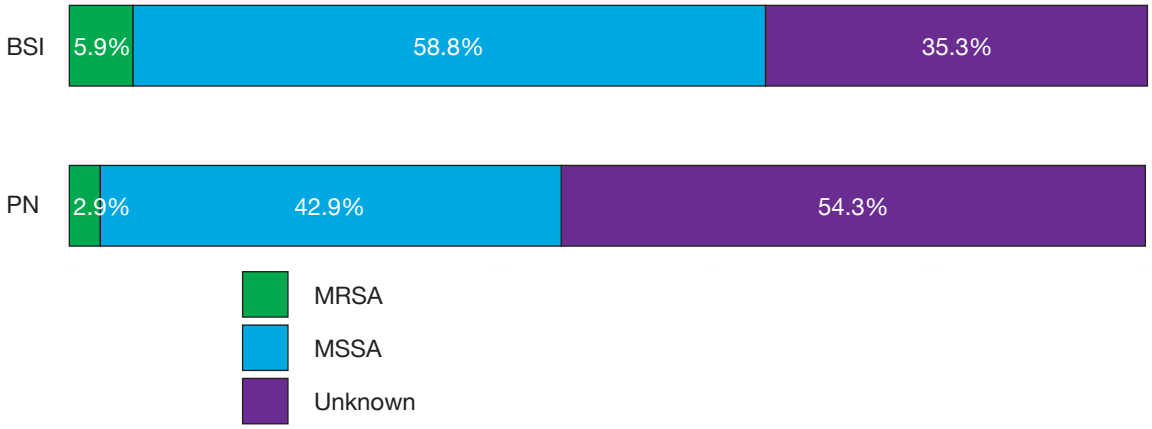


Figure 44 AMR phenotype of Staphylococcus aureus isolated from BSI (n=17) and pneumonia (n=35)



European data for HAI surveillance in ICU

A report of European surveillance data was published by ECDC in December 2017[9]. The report is based on analysis of surveillance data collected during 2015 from 15 European countries, including Scotland. The findings are summarised in Table 5, Scottish comparator data are included in the table.

HAI rates in Scotland are low when compared with other European countries. This highlights the need to ensure that the data collected in Scotland are validated and robust.

Table 5 European data for surveillance HAI in ICU

	BSI			PNEUMONIA		
	% patients	**Incidence** per 1000 patient days	**% Device Associated Infection**	**% patients**	**Incidence** per 1000 patient days	**% Device Associated Infection**
Europe[2]	3.8	2.0 (mean of all participating countries)	42.6	6.4	6.6	97.4
Scotland	1.2	1.8	62.2	1.5	2.1	96.0

The increase in VAP that was reported in 2016 has not continued, however work to validate these data has highlighted the need to further improve the data quality for the surveillance programme and ensure that data are robust and complete. This may involve a variety of approaches including data linkage and training in surveillance.

Intensive care is the hospital specialty which has the highest prevalence of HAI[10]. The majority of HAI in critical care are associated with device use and a significant proportion of these are considered to be preventable infections. Antimicrobial resistance is often high in ICU due to the severity of illness in ICU patients and frequent use of antibiotics. Therefore, infection prevention and control, and antimicrobial stewardship should remain a focus for intensive care in Scotland.

Conclusion

The SICSAG audit remains a comprehensive and ever expanding report of the activity, interventions and outcomes of patients who require critical care in Scotland.

Detailed individual unit level information is presented for scrutiny and to inform the public, health care professionals and managers about the high quality of scottish critical care. This report provides reassurance that the quality of critical care available within Scotland is of a very high standard. There is, however increasing evidence that some areas of the country really do lack sufficient numbers of intensive care beds.

The number of units participating in the audit continues to grow as critical care expands to encompass ever more patients. Hospital managers should seek to question why any critical care unit that falls within their remit has not joined SICSAG and to provide sufficient resource to ensure accurate and timely data collection.

The audit has developed into a highly co-ordinated, process driven, quality improvement programme that provides data, analysis and feedback. The expressed aims are to constantly raise standards and drive continued improvement in outcomes.

It is evident in this report that there is widespread support, clinical engagement and enthusiasm for ongoing continuous improvement amongst the critical care clinicians who care for those requiring critical care in Scotland.

Stephen Cole

Intensive Care Consultant

SICSAG Chair

Appendix A Other Publications

Abstracts from SICSAG data

SICSAG collaborated with the University of Edinburgh in 2017 to enable two students to participate in their dissertations whilst analysing data from SICSAG. One student had a formal honorary contract and worked closely with the central team for his work whilst the other used data from an Information Request for data. Both students successfully presented their work at the Scottish Intensive Care Society Annual Scientific meeting in St Andrew's in January 2018.

1. The development and validation of the APACHE-II model for predicting 30-day mortality in patients in Scottish Intensive Care Units

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1 Royal Infirmary of Edinburgh/University of Edinburgh, UK; 2 SICSAG, UK 3 NHS National Services Scotland, UK; 4 Western General Hospital, NHS Lothian; 5 Ninewells Hospital, NHS Tayside.

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The Scottish Intensive Care Society Audit Group (SICSAG) uses the APACHE-II risk model to enable fairer benchmarking of risk-adjusted in-hospital mortality for Scottish intensive care units (ICUs).1 However, using in-hospital mortality as an outcome introduces potential biases as it fails to account for variation in the organisation of services between health boards and differences in discharge policies. We hypothesized that a 30-day mortality risk prediction model would perform better than the current in-hospital mortality and aimed to identify units that performed differently between the two models.

Methods

This retrospective cohort study (2009–2016) used data from 30 general ICUs/combined units in the SICSAG database. Exclusion criteria were those stipulated in the APACHE II model. Primary outcomes were 30-day mortality and in-hospital mortality. The cohort was divided into derivation and validation cohorts. Multivariable logistic regression was used to develop the 30-day mortality prediction model in the derivation cohort. We validated the performance of the 30-day model by reporting the area under the curve (AUC) and calibration plots. We compared 30-day and in-hospital model performance in the validation cohort using de Long's test for AUC and visually comparing calibration plots. To identify units that performed differently using the 30-day model, change in unit SMR (ΔSMR) was calculated as the difference between the mean Scottish SMR and the SMR for each model. Non-overlapping 95% CIs for ΔSMRs for the two models with were deemed significant.

Results

A total of 78,054 patients were included in the study. The study cohort was split into a development cohort of 25,362 patients and a validation cohort of 52,692 patients. There were no significant differences between the development and validation datasets in age, sex, APACHE-II score, and length of ICU stay. The 30-day mortality and in-hospital mortality rates were 15,031 (19.3%) and 16,304 (20.9%), respectively. The AUC for the 30-day mortality model was 0.86 (95% CI 0.86 to 0.87) in comparison to 0.85 (95% CI 0.85 to 0.86) for the in-hospital mortality model (p=0.001). Calibration of the 30-day mortality model displayed excellent overall fit with most predicted estimates falling on the 45-degree line. In contrast, the in-hospital mortality model over-estimated mortality for all predicted risk groups greater than 30%. Mean SMR for 30-day mortality was 0.94, as opposed to 0.91 for in-hospital mortality. All unit SMRs except one were similar for both in-hospital and 30-day models. However, one unit demonstrated a significantly higher SMR using the 30-day compared with in-hospital mortality model (ΔSMR +0.07 vs -0.02, $p<0.05$).

Discussion

This study demonstrates that the performance of the 30-day mortality model was superior to the in-hospital mortality model in Scottish ICUs. A revised APACHE II model using 30-day mortality as the outcome could be used in SMR calculations to benchmark ICU performance in Scotland.

References

1. SICSAG. Audit of Critical Care in Scotland 2017 Annual Report. www.sicsag.scot.nhs.uk/publications/main.htm [04/10/2017]

2. Intensive care unit strain and non-clinical transfer rates: can we improve reporting of quality indicators?

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1 Royal Infirmary of Edinburgh/University of Edinburgh, UK; 2 SICSAG, NHS National Services Scotland; 3 Western General Hospital, NHS Lothian; 4 Ninewells Hospital, NHS Tayside.

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Introduction

The workload, or strain, in Intensive Care Units (ICUs) can fluctuate day to day[1]. One metric of strain is bed occupancy. Occupancy levels greater than 80% may adversely affect patient outcomes.[3,4] One outcome which may be particularly sensitive to unit strain is transfer of a patient between ICUs, in order to permit admission of a new patient to the unit ('non-clinical transfer' (NCT))[2]. SICSAG currently reports unit occupancy and NCT averaged over an annual basis[5]. However, annual occupancy may not adequately reflect the strain experienced by individual units. We aimed to assess the association between ICU strain measured by occupancy and NCT rates at a daily level, and to suggest further measures to reflect ICU strain.

Methods

Formal NHS ethical review was waived (ref NR/1609AB5). Data source: SICSAG database. Population: all patients admitted to Scottish ICUs 2006-2014. ICU strain was measured by bed occupancy level in each unit; the primary outcome was proportion of live discharges that were NCTs. Unit-years lacking complete occupancy data were omitted from analyses. Occupancy thresholds of 70%, 80% and 90% were chosen, following recommendations from previous literature[3,4]. We reported the proportion of unit-days with occupancy levels above and below these thresholds and compared the mean daily proportions of live discharges that were NCTs for each group (Student's T-test).

Results

After exclusions, data from 28 of Scotland's 31 ICUs were analysed. The sample comprised 58,177 unit-days during which 66,330 live discharges occurred. Over the study period, there were 435 (0.66%) NCTs. Annual occupancy was 73.7%, varying by unit and year (62.8-90.6%). 34,678 (59.6%) unit-days had >70% occupancy; 24,419 unit-days (42.0%) had >80% occupancy; and 13,354 unit-days (23.0%) had >90% occupancy. Four units had ≥40% of unit-days at >90% occupancy. Increasing daily occupancy was associated with increased NCT risk, with a rapid increase above 90% occupancy (Figure). For each occupancy threshold, mean daily proportion of NCTs was greater above the threshold than below (70% occupancy, 1.27% vs 0.10%,$p<0.001$; 80%, 1.71% vs 0.14%,$p<0.001$; 90%, 2.90% vs 0.18%,$p<0.001$).

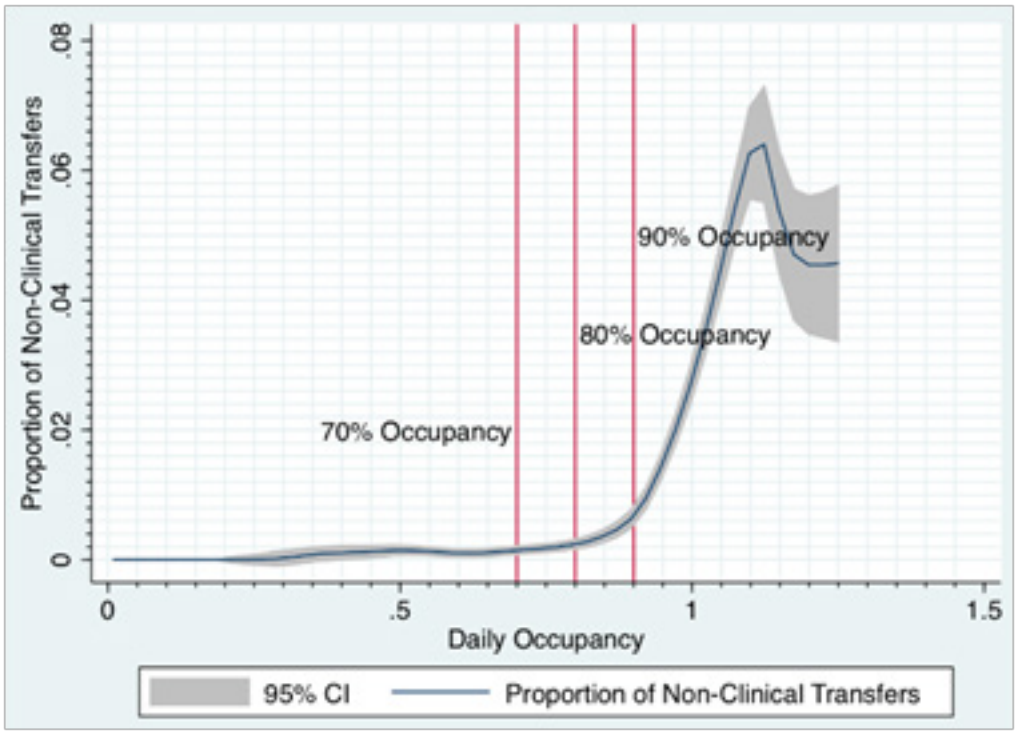
Conclusions

Our data show that, across Scottish ICUs, units are functioning at greater than 90% occupancy on almost 1 in 4 days. This increases the risk of NCT and associated consequences. Reporting additional metrics of unit strain, such as the time spent above different occupancy thresholds benchmarked against the Scottish average may allow more targeted interventions to mitigate the effects of strain on patient outcomes.

References

1. Halpern SD. Curr Opin Crit Care. 2011;17:648–57.
2. Barrat H, Harrison DA, Rowan KM, Raine R. Crit Care. 2012;16(5): R179
3. Valentin A, Ferdinande P, ESICM Working Group on Quality Improvement. Intensive Care Med. 2011;37:1575–87.
4. Tierney LT, Hons B, Conroy KM, Hons B. Aust Crit Care. 2014;27(2):77–84.
5. SICSAG. Audit of Critical Care in Scotland 2017 annual report.

Figure: Mean daily proportion of non-clinical transfers vs daily occupancy in Scottish Intensive Care Units



Published Papers using SICSAG data

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- Gillies MA, Harrison EM, Pearse RM, Garrioch S, Haddow C, Smyth L, Parks R, Walsh TS, Lone NI. Intensive care utilization and outcomes after high-risk surgery in Scotland: a population-based cohort study. Br J Anaesth. 2017 Jan;118(1):123-131. doi: 10.1093/bja/aew396. PubMed PMID: 28039249.

Appendix B Quality Improvement Project – Managing Pain in Intensive Care

Managing pain is challenging in the Intensive Care Unit (ICU) as often patients are unable to self-report due to the effects of sedation required for mechanical ventilation. Minimal sedative use and the utilisation of analgesia-first approaches are advocated as best practice to reduce unwanted effects of over-sedation and poorly managed pain. Despite evidence-based recommendations, behavioural pain assessment tools are not readily implemented in many critical care units. A local telephone audit conducted in April 2017 found that only 30% of Scottish ICUs are using these validated pain instruments.

The ICU at Raigmore Hospital, NHS Highland, initiated a quality improvement project using the Model for Improvement (MFI) to implement an analgesia-first approach utilising a validated and reliable behavioural assessment tool, namely the Critical-Care Pain Observation Tool (CPOT). Over a six-month period the project deployed quality improvement (QI) tools and techniques to test and implement the CPOT. The process measures related to (i) the nursing staff's reliability to assess and document pain scores at least every 4 hours and (ii) to treat the behavioural signs of pain or CPOT scores ≥ 3 with a rescue bolus of opioid analgesia.

The findings from this project confirm that the observed trends in both process measures had reduced over time. Four-hourly assessments of pain had increased to 89% and the treatment of CPOT scores ≥ 3 had increased to 100%.

Appendix C Unit Profiles 2017

The percentages of total nurses that are post registration trained in critical care are presented in this appendix. Units and NHS Boards should scrutinise this appendix to consider their nurse training requirements in critical care set against guidance and quality indicators.

The SICSAG Quality Indicator 1.4 states that “Critical Care Units should deliver care using only appropriately trained and experienced registered nursing staff”. Whilst it does not specifically define “appropriately trained” it does recognise that “appropriately trained and experienced registered nursing staff is critical care’s greatest asset and it is known to be associated with quality of care and improved patient outcomes”[2].

This MSQI is based on guidance issued from the UK Critical Care Nursing Alliance (UKCCNA)[11], The Core Standards for Intensive Care[12] and the Guidelines for the Provision of Intensive Care Services (GPICS)[13] that state that 50% of nurses should be in possession of a post registration critical care award. The UKCCNA also clarifies what constitutes a post registration Critical Care Course which can be legitimately counted by units to meet this target by the following statement;

“Any critical care course commissioned by service providers and considered to meet the previous scope of the ENB 100; courses would need to have included academic and practical components of post registration critical care nurse education and a rigorous assessment process. This does not include short in house courses.”[11]

Table C1 ICUs and combined units (2017)

Hospital	Actual beds	Funded beds (Level 3/2)	Trained Nurse WTE per level 3 bed*	Percentage of total nursing are post registration trained in critical care	The period in weeks of supernumerary for new nursing starts in the unit	Microbiologist	Dietetic review available
ARI General	16	11	8.7	72%	4 weeks	Everyday	Weekdays only
AYR	5	4	7.17	78%	4 weeks	Everyday	Weekdays only
Crosshouse	7	5.5	6.82	29%	4-8 weeks	Everyday	Weekdays only
DGRI	6	4	6.74	22%	2 weeks	Everyday	Weekdays only
VHK	10	9	6.10	30%	7 weeks	Everyday	Weekdays only
QEU	20	18	6.17	66%	4 weeks	Everyday	Weekdays only
IRH[1]	2	2	4.50	40%	4 weeks	Everyday	Weekdays only
RAH	8	7	6.26	45%	3- 6 weeks	Everyday	Weekdays only
Raigmore	8	7	8.57	18%	3 weeks	Everyday	Weekdays only
Wishaw	5	5.3	5.70	29%	4 weeks	Everyday	Weekdays only
Ninewells	9	8	6.00	88%	4 weeks	Everyday	Weekdays only
PRI	4	3	3.60	30%	4 weeks	Everyday	Weekdays only
BGH	9	6	5.17	49%	2-3 weeks	Everyday	Weekdays only
FVRH	19	7/12	5.68	67%	2 weeks	Everyday	Weekdays only
GRI	20	12/8	6.50	85%	3 weeks	Everyday	Weekdays only
Hairmyres[2]	10	5/4	5.60	84.20%	2 weeks	Everyday	Weekdays only
MDGH ICU/HDU Combined	10	8	5.46	30%	2 weeks	Everyday	Weekdays only
RIE General	18	16/2	5.93	60%	2-3 weeks	Everyday	Weekdays only
SJH	7	3/2	6.65	70%	4 weeks	Everyday	Weekdays only
WGH	16	10/6	6.3*	70%	2-3 weeks	Everyday	Weekdays only
ARI Cardio	6	5	5*	57%	4 weeks	Everyday	Weekdays only
RIE Cardio	11	9	6.69	80%	4 weeks	Everyday	Weekdays only
SGH Neuro	9	6	6.31	57%	4-8 weeks	Everyday	Weekdays only
GJNH Critcare[3]	22	20/12	4.04	50%	4 weeks	Everyday	Weekdays only

Notes

1 Currently under review (ICU 2 beds, HDU 4 beds and CCU 11 beds has a total funded establishment of 43.79 wte with current staffing at 48.74 wte)

2 Funded beds increase in winter months.

3 Available beds vary daily from Friday to Tuesday.

* Whole Time Equivalent per level 3 bed.

Table C2 HDUs (2017)

Hospital	Actual beds	Funded beds (Level 2/1)	Trained Nurse WTE per level 2 bed*	Percentage of total nursing are post registration trained in critical care	The period in weeks of supernumerary for new nursing starts in the unit	Microbiologist	Dietetic review available
Ayr HDU[1]	4	4	2.6	83%	4 weeks	Everyday	Weekdays only
Dr Gray's HDU	8	8	1.9	0%	2-4 weeks	Everyday	Weekdays only
QEU HDU6	30	26	3.2	75%	4 weeks	Everyday	Weekdays only
IRH HDU[2,3]	4	4	4.5	40%	4 weeks	Everyday	Weekdays only
RAH HDU	12	12	3.0	24%	4 weeks	Everyday	Weekdays only
Belford HDU	2	2	1	9%	3 days	Everyday	Weekdays only
RIE HDU	11	11	3.6	40%	2 weeks	Everyday	Weekdays only
Balfour Hospital HDU	2	2	5.1	0%	2 weeks	Everyday	Weekdays only
GBH HDU[4]	2	No separate funding	Staffed as required	50%	2 weeks	Everyday	Weekdays only
PRI HDU	4	4	3.5	21%	1 month	Everyday	Weekdays only
WIH HDU	4	0/4	0.5	40-50%	4 weeks	Everyday	Weekdays only
Crosshouse MHDU	12	8/4	2.7	41%	2 weeks	Weekdays only	Weekdays only
DGRI MHDU	8	8	3.0	17%	2 weeks	Everyday	Weekdays only
VHK MHDU	8	8	3.1	4%	4-6 weeks	Everyday	Weekdays only
ARI MHDU	14	10	5.93	60%	2-3 weeks	Everyday	Weekdays only
GRI MHDU	8	8	3.2	40%	3 days	Everyday	Weekdays only
QEU HDU5	9	9	2.7	24%	4 weeks	Everyday	Weekdays only
Raigmore MHDU	5	5	3.5	0%	1 week	Everyday	Weekdays only
Hairmyres MHDU	4	4	2.8	6%	2 weeks	Everyday	Weekdays only
MDGH MHDU	22	4	3.6	0%	2 weeks	Everyday	Weekdays only
Wishaw MHDU	12	6/6	3.4	0%	2 weeks	Everyday	Weekdays only
Ninewells MHDU	6	6	3.2	86%	2 weeks	Everyday	Weekdays only
Crosshouse SHDU	12	8/4	3.0	60%	6 weeks	Everyday	Weekdays only
DGRI SHDU	4	4	4.0	38%	2 weeks	Everyday	Weekdays only
VHK SHDU	8	8	3.0	10%	4-6 weeks	Everyday	Weekdays only
ARI SHDU	18	18	3.0	37%	4 weeks	Everyday	Weekdays only
GRI SHDU	8	8	3.3	88%	3 weeks	Everyday	Weekdays only
Raigmore SHDU	6	6	3.0	0%	2-3 weeks	Everyday	Weekdays only
MDGH SHDU (LEVEL 1)	6	0/6	1.3	16%	2 weeks	Everyday	Weekdays only

Hospital	Actual beds	Funded beds (Level 2/1)	Trained Nurse WTE per level 2 bed*	Percentage of total nursing are post registration trained in critical care	The period in weeks of supernumerary for new nursing starts in the unit	Microbiologist	Dietetic review available
Wishaw SHDU	7	6.7	2.9	29%	4 weeks	Everyday	Weekdays only
WGH SHDU	10	6/4	2.9	65%	2 weeks	Weekdays only	Weekdays only
Ninewells SHDU	10	10	3.6	34%	4 weeks	Everyday	Weekdays only
VHK RHDU	3	3	1.4	0%	2 weeks	Everyday	Weekdays only
ARI OHDU[4]	1*	No separate funding	2.0	25%	2 weeks	Everyday	Weekdays only
GRI OHDU[4]	2	No separate funding	NA	0%	0	Everyday	Weekdays only
QEU OHDU[2]	2	No separate funding	NA	15%	5 days	Everyday	Weekdays only
RIE OHDU[4]	3	No separate funding	NA	47%	1-2 weeks	Everyday	Sporadic
Ninewells OHDU[4,5]	2	No separate funding	NA	100%	5 days	Everyday	Weekdays only
RIE RTHDU	16	12	3.4	74%	4 weeks	Everyday	Weekdays only
RIE CHDU	10	8	3.8	65%	1 week	Everyday	Weekdays only
WGH NHDU/ NHDU (level 1)	7	4/3	3.0*	24%	2 weeks	Weekdays only	Weekdays only
SGH NHDU	6	6	2.8	66%	4 weeks	Everyday	Weekdays only

Beds are represented as a total equivalent of funded level 3 beds. Funded level 2 beds are counted as 0.5 of a funded level 3 bed.

Key:
SHDU – Surgical HDU
MHDU – Medical HDU
NHDU – Neurological HDU
CHDU – Cardiothoracic HDU
OHDU – Obstetric HDU
RHDU – Renal HDU
RTHDU – Renal Transplant HDU

Notes

1 Staff rotate from the general ward; two trained nurses are allocated to HDU every shift.

2 HDUs are open when necessary and staffed by ward nurses (with HDU training). Occupancy is calculated on two beds in this unit.

3 Currently under review (ICU 2 beds, HDU 4 beds and CCU 11 beds has a total funded establishment of 43.79 wte with current staffing at 48.74 wte).

4 HDUs are open when necessary and staffed by ward nurses (with HDU training). Occupancy is calculated on one bed in these units.

5 Level 0 patients are excluded from the occupancy calculations for this unit.

Quality Indicator

* Whole time equivalent per level 2 bed.

Appendix D Number of annual admissions

Table D1 Number of annual admissions to ICU and combined units (2008-2017)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
NHS Ayrshire & Arran										
Ayr ICU	330	330	292	252	268	243	255	270	223	238
Crosshouse ICU	304	294	305	319	302	276	269	287	273	307
NHS Borders										
BGH ICU/HDU	406	397	429	506	600	579	586	561	543	526
NHS Dumfries & Galloway										
DGRI ICU[1]	316	285	298	293	314	323	286	313	301	299
DGRI ICU/HDU1										84
NHS Fife										
QMH ICU	382	437	439	449	22					
VHK ICU					394	453	428	407	391	398
VHK ICU/HDU	124	38								
NHS Forth Valley										
FVRH ICU/HDU				577	1189	1159	1260	1308	1264	1193
SRI ICU	443	378	411	214						
NHS Grampian										
ARI ICU	762	717	748	665	676	821	765	669	655	712
ARI CICU						279	483	453	458	443
NHS Greater Glasgow and Clyde										
GRI ICU/HDU	395	426	461	793	952	1060	973	1056	1199	1210
IRH ICU	104	82	120	150	138	137	130	112	100	111
RAH ICU	359	360	433	402	374	359	346	369	360	343
SGH ICU	299	289	278	282	264	232	279	103		
SGH NICU	454	461	451	395	347	377	437	456	411	384
Stobhill ICU	233	202	155	40						
VI ICU	284	317	298	280	284	289	246	99		
WIG ICU	554	495	485	475	393	421	391	136		
QEU ICU								497	842	839
NHS Highland										
Raigmore ICU	391	429	433	383	423	433	404	374	374	404
NHS Lanarkshire										
Hairmyres ICU/HDU	505	560	562	583	558	615	565	619	673	655
MDGH ICU	278	252	225	273	267	307	298	308	93	
MDGH ICU/HDU									471	593
Wishaw ICU	619	222	229	237	212	235	257	259	270	256
NHS Lothian										
RIE ICU/HDU	1092	968	1110	1177	1230	1236	1267	1262	1297	1250
RIE CICU				188	926	1011	1038	1023	1039	1061
SJH ICU/HDU	443	465	424	444	452	458	387	371	365	386
WGH ICU/HDU	772	831	735	705	647	676	721	633	667	710
NHS National Waiting Times Centre										
Golden Jubilee National Hospital ICU/HDU[2]					1318	2223	2255	2084	2130	2155
NHS Tayside										
Ninewells ICU	404	386	357	349	417	378	391	368	386	383
PRI ICU	156	136	122	119	140	124	166	132	123	132
Total	**10409**	**9757**	**9800**	**10550**	**13107**	**14704**	**14883**	**14529**	**14908**	**15072**
Total (excluding specialist units)	**9955**	**9296**	**9349**	**9967**	**10516**	**10814**	**10670**	**10513**	**10870**	**11029**

Notes:

1. In December 2017 Dumfries & Galloway ICU merged with the MHDU and SHDU to form a Combined Unit at the new hospital.
2. Golden Jubilee have two ICUs and two HDUs but for the purpose of this audit are reported as one combined ICU/HDU.

NHS Boards

Shaded areas refer to periods with incomplete data collection

Combined Unit

Key:

CICU – Cardiothoracic ICU

NICU – Neurological ICU

Table D2 Number of annual admissions to HDU (2008-2017)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
NHS Ayrshire and Arran										
Ayr HDU	542	527	498	487	469	474	498	500	484	447
Crosshouse MHDU	997	974	1033	1103	1193	1201	1102	1053	1084	1084
Crosshouse SHDU	728	711	644	641	644	669	723	754	740	698
NHS Borders										
BGH Surgical (Level 1)	310	339	254							
NHS Dumfries and Galloway										
DGRI MHDU[1]	393	392	431	418	437	431	456	434	395	376
DGRI SHDU[1]	823	804	854	731	788	824	868	759	736	773
NHS Fife										
QMH SHDU	849	840	816	813	34					
QMH MHDU			525	724	37					
QMH RHDU				155						
Victoria Hospital SHDU					817	903	883	941	872	845
Victoria Hospital MHDU					937	1088	1084	1136	1104	999
Victoria Hospital RHDU					159	210	202	224	163	187
VHK Medical HDU (old unit)			429	444						
NHS Forth Valley										
Stirling HDU	1089	963	992	558						
NHS Grampian										
ARI SHDU (Ward 503)[2]	582	623	714	630	575	609	654	619	471	120
ARI SHDU (Ward 506)[2]		780	814	868	892	856	871	802	845	229
ARI MHDU								575	1091	1040
ARI OHDU									122	321
ARI SHDU[2]										1407
Dr Gray's HDU		797	1083	1169	1069	1068	986	950	1007	973
NHS Greater Glasgow and Clyde										
GRI Princess OHDU								95	235	248
QEU HDU1								590	946	963
QEU HDU2								494	824	914
QEU HDU6								406	739	945
QEU MHDU								607	1101	1104
QEU OHDU									76	238
GRI SHDU	1051	1053	1026	765	629	621	650	624	647	659
GRI MHDU					533	671	679	720	735	726
IRH SHDU		266	432	469	439	485	526	479	550	569
RAH HDU	1291	1289	1339	1459	1497	1418	1414	1453	1486	1481
SGH SHDU	861	870	807	693	711	692	696	228		
SGH NHDU	675	660	647	621	594	637	706	681	594	602
Stobhill SHDU	327	337	287	58						
VI SHDU	692	636	700	812	847	873	835	317		
GGH HDU	885	882	904	755	755	761	806	304		
WIG HDU			75	413	438	427	443	123		
NHS Highland										
Raigmore MHDU	718	730	811	803	743	774	804	806	728	968
Raigmore SHDU	620	677	669	669	653	657	629	595	636	582
Belford HDU				74	78	114	100	63	101	108

Table D2 Number of annual admissions to HDU (2008-2017)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
NHS Lanarkshire										
Hairmyres MHDU				274	375	254	223	385	415	391
MDGH SHDU	601	593	569	565	588	618	592	574	164	
MDGH MHDU		56	278	283	377	438	406	452	425	358
MDGH L1									400	424
Wishaw SHDU	154	602	532	546	571	526	488	498	520	481
Wishaw MHDU					265	1245	1188	1172	1245	1171
NHS Lothian										
RIE HDU	1541	1390	1369	1366	1377	1329	1300	1282	1305	1434
RIE RHDU	667	632	674	675	634	650	682	715		
RIE THDU	338	306	345	296	325	375	392	368		
RIE Vascular (Level 1)		112	452	378	372	330	331	341	361	
RIE CHDU				214	1118	1223	1249	1303	1403	1402
RIE RTHDU									822	1064
RIE OHDU[3]										557
WGH SHDU	1192	1126	1119	1136	1112	1115	1160	1184	1094	1129
WGH NHDU[4]	230	285	404	476	431	481	493	480	469	654
WGH Neurological (Level 1)[4]			52	418	364	475	469	432	419	111
NHS Orkney										
Balfour HDU					78	138	258	277	267	230
NHS Shetland										
GBH HDU	63	49	58	74	65	77	69	66	54	63
NHS Tayside										
Ninewells SHDU	832	742	754	794	784	816	812	842	846	837
Ninewells MHDU		558	641	673	743	709	782	829	839	832
Ninewells OHDU[5]							822	915	716	75
Perth HDU	623	644	618	625	659	612	576	516	525	558
NHS Western Isles										
WIH HDU		145	414	448	417	301	344	414	496	482
Total	**19674**	**22390**	**25063**	**25573**	**26623**	**28175**	**29251**	**30377**	**31297**	**31859**
Total (14 units)	**11078**	**10811**	**11060**	**11070**	**11121**	**11169**	**11273**	**11044**	**10694**	**10705**

Notes:

1. In December 2017 Dumfries & Galloway ICU merged with the MHDU and SHDU to form a Combined Unit at the new hospital.
2. In April 2017 the two surgical units at ARI merged to form a new SHDU.
3. RIE OHDU joined the audit in January 2017.
4. WGH level 1 unit and WGH NHDU merged in April 2017.
5. The methodology for included patients for this year has changed, with all level 0 and some level 1 patients not recorded in the audit from 2017.

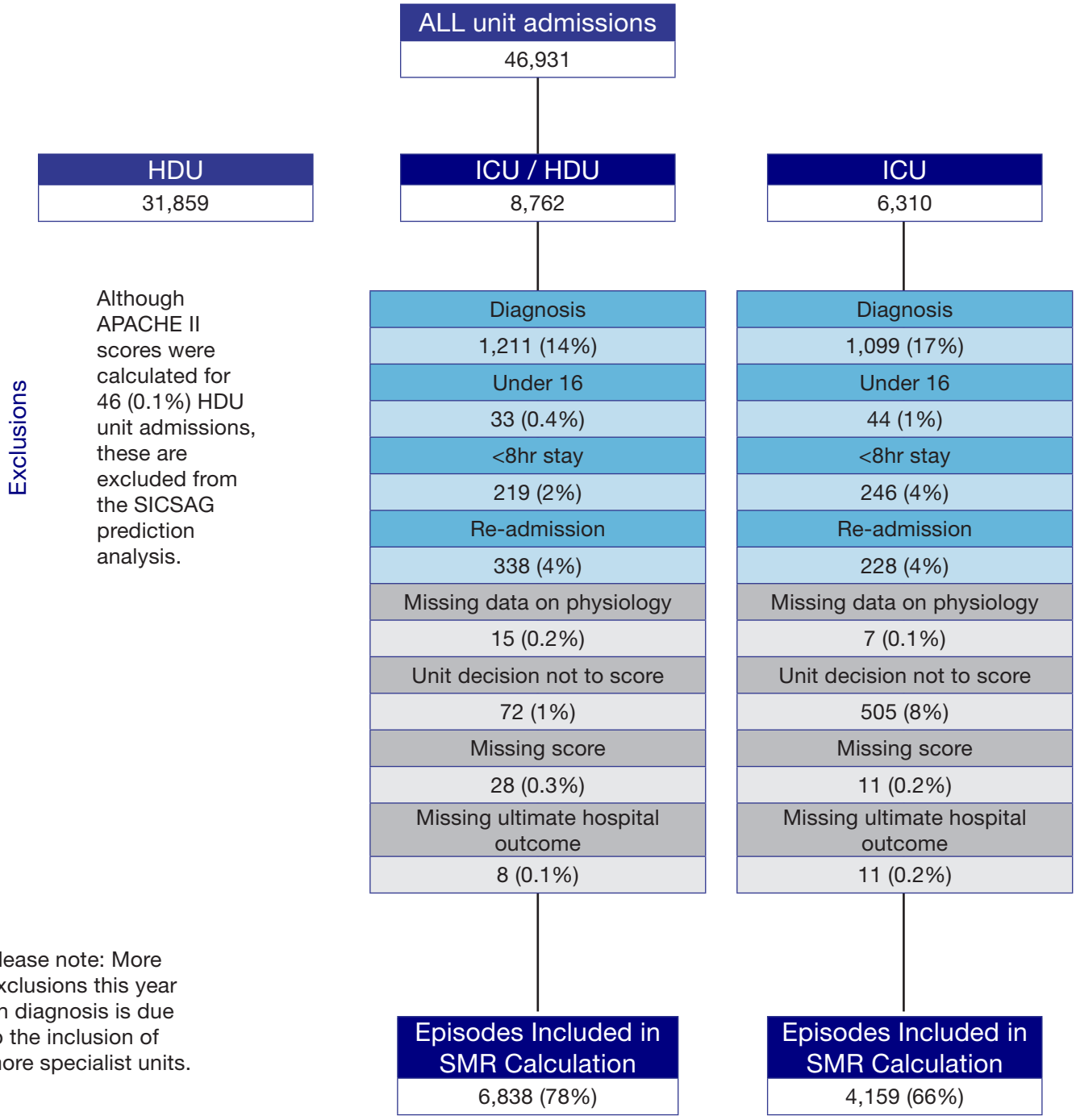
NHS Boards

Shaded areas refer to periods with incomplete data collection

Key:

SHDU – Surgical HDU
MHDU – Medical HDU
NHDU – Neurological HDU
CHDU – Cardiothoracic HDU
RHDU – Renal HDU
OHDU – Obstetrics HDU
RTHDU – Renal Transplant DHDU

Appendix E Eligibility for APACHE II scores and selection for analysis (2017)



Please note: More exclusions this year on diagnosis is due to the inclusion of more specialist units.

Appendix F Unit Key

NHS Board	Letter	Unit Key
Ayrshire & Arran	E	Ayr ICU
Ayrshire & Arran	E2	Ayr HDU
Ayrshire & Arran	G	Crosshouse ICU
Ayrshire & Arran	G2	Crosshouse MHDU
Ayrshire & Arran	G3	Crosshouse SHDU
Borders	U	BGH ICU/HDU
Dumfries & Galloway	H	DGRI ICU
Dumfries & Galloway	H2	DGRI MHDU
Dumfries & Galloway	H3	DGRI SHDU
Dumfries & Galloway	H4	DGRI ICU/HDU
Fife	B	VHK ICU
Fife	B2	VHK MHDU
Fife	B3	VHK SHDU
Fife	B4	VHK RHDU
Forth Valley	Q3	FVRH ICU/HDU
Grampian	AA1	Dr Grays HDU
Grampian	W	ARI ICU
Grampian	W14	ARI SHDU
Grampian	W2	ARI SHDU (31/32)
Grampian	W4	ARI SHDU (35)
Grampian	W7	ARI CICU
Grampian	W8	ARI MHDU
Grampian	W9	ARI OHDU
Greater Glasgow & Clyde	A	IRH ICU
Greater Glasgow & Clyde	A2	IRH HDU
Greater Glasgow & Clyde	G4	PRM OHDU
Greater Glasgow & Clyde	J	RAH ICU
Greater Glasgow & Clyde	J2	RAH HDU
Greater Glasgow & Clyde	K	GRI ICU / HDU
Greater Glasgow & Clyde	K2	GRI SHDU
Greater Glasgow & Clyde	K3	GRI MDU
Greater Glasgow & Clyde	QE1	QEU ICU
Greater Glasgow & Clyde	QE2	QEU HDU1
Greater Glasgow & Clyde	QE3	QEU HDU2
Greater Glasgow & Clyde	QE4	QEU HDU6
Greater Glasgow & Clyde	QE5	QEU MHDU

NHS Board	Letter	Unit Key
Greater Glasgow & Clyde	QE6	QEU OHDU
Greater Glasgow & Clyde	Y	SGH NICU
Greater Glasgow & Clyde	Y2	SGH NHDU
Highland	AC1	Belford HDU
Highland	P	Raigmore ICU
Highland	P2	Raigmore MHDU
Highland	P3	Raigmore SHDU
Lanarkshire	I3	MDGH MHDU
Lanarkshire	I4	MNK ICU/HDU
Lanarkshire	I5	MNK level 1 HDU
Lanarkshire	S	Hairmyres ICU/HDU
Lanarkshire	S2	Hairmyres MHDU
Lanarkshire	V	Wishaw ICU
Lanarkshire	V2	Wishaw SHDU
Lanarkshire	V3	Wishaw MHDU
Lothian	M	SJH ICU/HDU
Lothian	R	WGH ICU/HDU
Lothian	R3	WGH SHDU
Lothian	R4	WGH NHDU
Lothian	R5	WGH NHDU (Level 1)
Lothian	X	RIE ICU/HDU
Lothian	X13	RIE RTHDU
Lothian	X14	RIE OHDU
Lothian	X2	RIE HDU
Lothian	X6	RIE CICU
Lothian	X7	RIE CHDU
National Waiting Times Centre	AD1	GJNH CICU/CHDU
Orkney	AE1	Balfour HDU
Shetland	Z1	GBH HDU
Tayside	C	PRI ICU
Tayside	C2	PRI HDU
Tayside	N	Ninewells ICU
Tayside	N2	Ninewells MHDU
Tayside	N3	Ninewells SHDU
Tayside	N5	Ninewells OHDU
Western Isles	AB1	WIH HDU

Letter	Unit Key	NHS Board
A	IRH ICU	Greater Glasgow & Clyde
A2	IRH HDU	Greater Glasgow & Clyde
AA1	Dr Grays HDU	Grampian
AB1	WIH HDU	Western Isles
AC1	Belford HDU	Highland
AD1	GJNH CICU/CHDU	National Waiting Times Centre
AE1	Balfour HDU	Orkney
B	VHK ICU	Fife
B2	VHK MHDU	Fife
B3	VHK SHDU	Fife
B4	VHK RHDU	Fife
C	PRI ICU	Tayside
C2	PRI HDU	Tayside
E	Ayr ICU	Ayrshire & Arran
E2	Ayr HDU	Ayrshire & Arran
G	Crosshouse ICU	Ayrshire & Arran
G2	Crosshouse MHDU	Ayrshire & Arran
G3	Crosshouse SHDU	Ayrshire & Arran
G4	PRM OHDU	Greater Glasgow & Clyde
H	DGRI ICU	Dumfries & Galloway
H2	DGRI MHDU	Dumfries & Galloway
H3	DGRI SHDU	Dumfries & Galloway
H4	DGRI ICU/HDU	Dumfries & Galloway
I3	MDGH MHDU	Lanarkshire
I4	MNK ICU/HDU	Lanarkshire
I5	MNK level 1 HDU	Lanarkshire
J	RAH ICU	Greater Glasgow & Clyde
J2	RAH HDU	Greater Glasgow & Clyde
K	GRI ICU / HDU	Greater Glasgow & Clyde
K2	GRI SHDU	Greater Glasgow & Clyde
K3	GRI MDU	Greater Glasgow & Clyde
M	SJH ICU/HDU	Lothian
N	Ninewells ICU	Tayside
N2	Ninewells MHDU	Tayside
N3	Ninewells SHDU	Tayside
N5	Ninewells OHDU	Tayside

Letter	Unit Key	NHS Board
P	Raigmore ICU	Highland
P2	Raigmore MHDU	Highland
P3	Raigmore SHDU	Highland
Q3	FVRH ICU/HDU	Forth Valley
QE1	QEU ICU	Greater Glasgow & Clyde
QE2	QEU HDU1	Greater Glasgow & Clyde
QE3	QEU HDU2	Greater Glasgow & Clyde
QE4	QEU HDU6	Greater Glasgow & Clyde
QE5	QEU MHDU	Greater Glasgow & Clyde
QE6	QEU OHDU	Greater Glasgow & Clyde
R	WGH ICU/HDU	Lothian
R3	WGH SHDU	Lothian
R4	WGH NHDU	Lothian
R5	WGH NHDU (Level 1)	Lothian
S	Hairmyres ICU/HDU	Lanarkshire
S2	Hairmyres MHDU	Lanarkshire
U	BGH ICU/HDU	Borders
V	Wishaw ICU	Lanarkshire
V2	Wishaw SHDU	Lanarkshire
V3	Wishaw MHDU	Lanarkshire
W	ARI ICU	Grampian
W14	ARI SHDU	Grampian
W2	ARI SHDU (31/32)	Grampian
W4	ARI SHDU (35)	Grampian
W7	ARI CICU	Grampian
W8	ARI MHDU	Grampian
W9	ARI OHDU	Grampian
X	RIE ICU/HDU	Lothian
X13	RIE RTHDU	Lothian
X14	RIE OHDU	Lothian
X2	RIE HDU	Lothian
X6	RIE CICU	Lothian
X7	RIE CHDU	Lothian
Y	SGH NICU	Greater Glasgow & Clyde
Y2	SGH NHDU	Greater Glasgow & Clyde
Z1	GBH HDU	Shetland

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